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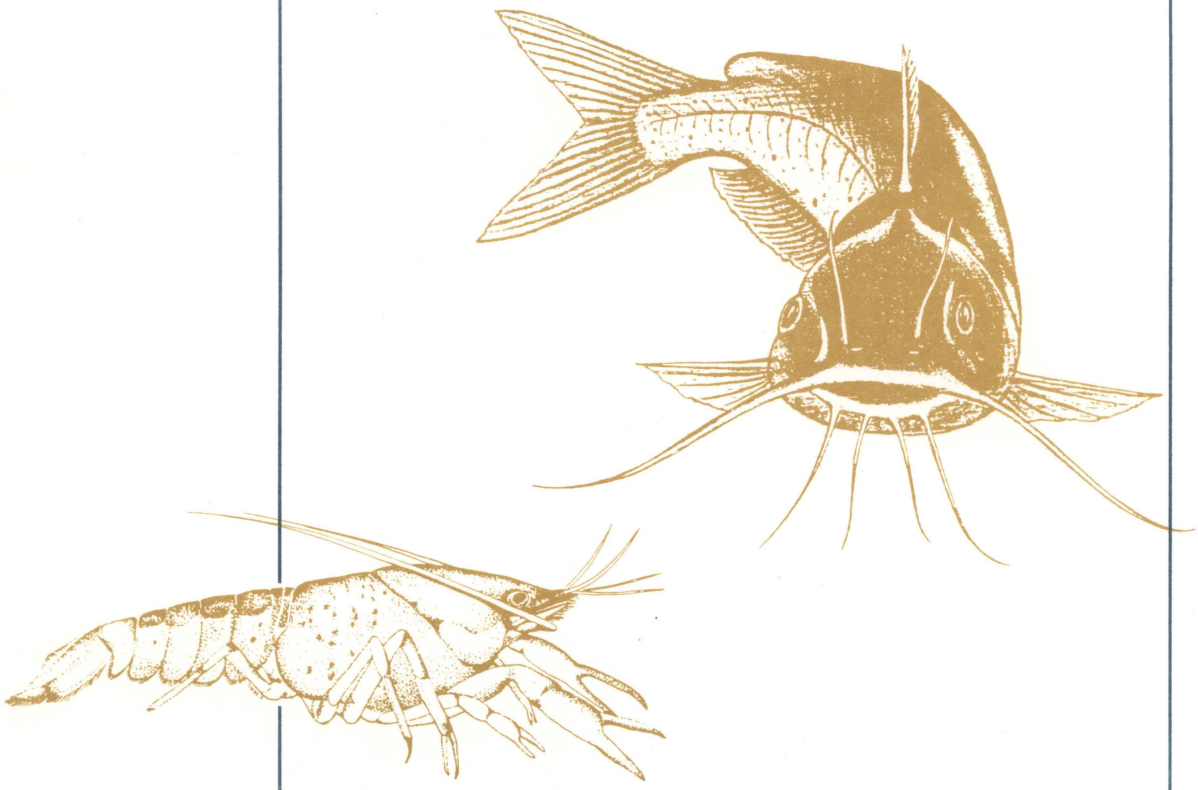
Analysis of a Local Retail Market for Catfish and Crawfish



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Analysis of a Local Retail Market for Catfish and Crawfish

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Keywords: catfish, crawfish, market analysis.

Contents

Executive Summary

Aquaculture is a major industry in several southern states, where key aquacultural products include catfish and crawfish. Production levels during the last decade have grown substantially in the aquacultural industry. Little work, however, has been done to assist industry planners in developing effective marketing programs. This lack of knowledge is a formidable barrier to market expansion and stability.

The Southern Regional Aquaculture Center (SRAC) identified the lack of market information as a critical industry need. In 1988, in recognition of this need, the SRAC commissioned a project involving researchers from Alabama, Arkansas, Louisiana, Mississippi, South Carolina, and Texas. The overall goal of this project was to gather information to facilitate the expansion of markets for catfish and crawfish produced in the southern region.

In this light, this research herein reported deals with analyses of catfish and crawfish products at the retail grocer level. Specifically, the objectives were twofold: (1) to evaluate marketable product forms of catfish and crawfish in supermarkets through the use of scanner data and (2) to estimate retail demand relationships for catfish and crawfish. The time frame of the study is the period January 1987 to November 1988. The source of data is a retail food firm in Houston, Texas. Consequently, this analysis lies within the boundaries of the traditional catfish and crawfish markets. According to McGee et al. (1989), the south-central region of the United States consumes approximately 45 percent of all catfish produced.

Work with scanner data is not a trivial task. Much careful and organized computation is necessary to conduct analyses successfully using scanner data.

This study rests on weekly point-of-sale purchases of catfish and crawfish products. The items correspond to either fresh or convenience (processed) products. The convenience catfish products are Mrs. Paul's Catfish Strips, Hormel Catfish Fillets, and Hormel Catfish Bobber Snacks. The fresh catfish products are fresh whole catfish, fresh farm-raised catfish fillets (the aquacultural product in this analysis), and fresh ocean catfish fillets. Similarly, the single convenience crawfish product is Cajun Cook Crawfish Etouffe with Rice. The two fresh crawfish products are fresh cooked crawfish and frozen cooked crawfish meat. The weekly observations (97 in all) began on Wednesday and ended on Tuesday to conform to retail food firm sales and advertising patterns. Importantly, the retail food firm in this study caters to relatively high-income customers.

Customer counts per week for this firm ranged from 577,428 to 861,844 over the time frame analyzed. Advertisement space (in terms of square centimeters) of the respective products varied considerably from week to week. The principal finfish and shellfish products in terms of print space and frequency of advertisement were catfish and shrimp, respectively. Catfish and crawfish received roughly 27 and 1 square centimeters, respectively, of print space on average. The share of finfish advertisement space for catfish was 26 percent, whereas the share of shellfish advertisement space for crawfish was about 0.3 percent. In terms of frequency, advertisements for catfish occurred 48 out of 97 weeks, whereas advertisements for crawfish occurred only once. The availability of fresh catfish relative to fresh crawfish may affect advertisement frequency.

Fresh catfish products constituted roughly 90 percent of all catfish sales during our study. Fresh catfish products generated about $13,570 in sales per week for this retail food firm. The principal fresh catfish products are fresh farm-raised catfish fillets and fresh whole catfish. Convenience catfish products gave rise to roughly $1,500 in sales per week, about 10 percent of all catfish sales. The key convenience catfish products in terms of dollar sales were Hormel Catfish Bobber Snacks and Mrs. Paul's Catfish Strips. For the retail firm, convenience crawfish products constituted $789 weekly in sales, approximately 84 percent of all crawfish sales. Fresh crawfish products constituted the remaining 16 percent. The principal fresh crawfish product was fresh cooked crawfish meat.

With few exceptions, purchases of catfish and crawfish products varied tremendously on a weekly basis. The purpose of this study's econometric analysis, perhaps the cornerstone of the project, is to develop models to explain such variation in product movement.

The econometric models correspond to demand relationships at the retail level. The dependent variable in the respective demand relationships is purchases per 1,000 customers. The respective exogenous variables are (1) own-price; (2) prices of competing products; (3) advertisement variables; and (4) seasonality. Emphasis is on price and advertisement elasticities. Price elasticities refer to percentage changes in purchases caused by unit percentage changes in prices; similarly, advertising elasticities refer to percentage changes in purchases caused by unit percentage changes in advertising. Elasticities reveal the sensitivity of purchases to price changes and/or to promotion efforts.

Generally, for both crawfish and catfish products, the explanatory power of the econometric models is on the order of 50 to 70 percent. The econometric models are satisfactory, especially with the relatively large amount of variation to be explained on a week-to-week basis.

All own-price elasticities are negative and, except for fresh ocean catfish fillets, fresh crawfish, and fresh cooked crawfish, are statistically significant. The respective elasticities are in the elastic range for all catfish products except for the aggregate convenience catfish. The own-price elasticities for the individual convenience catfish products range from -2.723 to -13.652, and for fresh catfish, the range is from -1.295 to -6.046. The own-price elasticity for fresh crawfish is -0.835, and the own-price elasticity for Cajun Cook Crawfish Etouffe with Rice is -0.812. The demand for fresh cooked crawfish is price elastic. The magnitude of this elasticity is -2.682. In sum, sample evidence exists to indicate that own-price exerts a notable influence on purchases, holding all other factors constant.

For fresh catfish products, only 6 of 24 cross-price elasticities are statistically different from zero. For convenience catfish products, 5 of 18 cross-price elasticities are statistically different from zero.

For the prepared entree Cajun Cook Crawfish Etouffe with Rice, shellfish is the only statistically significant cross-price variable. The price of beef, the price of finfish, and the price of shellfish influence purchases of fresh crawfish. Prices of competing products, however, do not bear greatly on purchases of fresh cooked crawfish.

Own-advertisement elasticities are positive and statistically significant for fresh farm-raised catfish fillets and the aggregate of all fresh catfish products. The respective own-advertisement elasticities for these products are 0.058 and 0.109, much smaller in magnitude than the corresponding own-price elasticities. Own-advertisement effects are not significant for crawfish products.

With few exceptions, virtually no linear association exists between product price and product exposure (advertisement space). For fresh farm-raised catfish fillets, a significant, albeit relatively small, negative association is evident. Importantly, few cross-advertisement effects are significantly different from zero. That is, advertisement exposure for finfish, shellfish, and the aggregate of beef, pork, poultry, lamb, and veal only slightly affects purchases of crawfish and catfish.

Because demand for individual catfish products in the retail firm studied is elastic, incentive to lower prices exists. Such a strategy results in increases in total revenue. This strategy is particularly important because of the general insignificance of cross-product prices. For fresh farm-raised catfish fillets, a strategy to increase advertisement exposure may be worthwhile to boost demand. However, strategies to alter advertisement exposure for various products to increase demand for other catfish and crawfish products appear not to be worthwhile.

Seasonality is a key determinant in purchases of all catfish products, except for whole catfish. For crawfish, on the other hand, seasonality is a key factor only in purchases of fresh cooked crawfish or fresh crawfish.

Although scanner data have been available for several years to marketers, such data represent a new form of information to the aquacultural sector. This study constitutes a pilot test of the use of scanner data to investigate the demand for catfish and crawfish products for a local market.

Despite the apparent success in analyzing retail demand relationships with scanner data for catfish and crawfish products, concern lies with generalizing the results to regional or national levels. Scanner data from supermarkets in a particular location represent a "controlled" experimental situation. The community-specific results may not allow defensible, broad nationwide or regional inferences. Because of this potential limitation, the results of local analyses (such as this study) should not be used on a stand-alone basis. Although this analysis is limited geographically to the Houston area, the methodology can be replicated in other regions.

Introduction

Aquaculture is a major industry in several southern states, where key aquacultural products include catfish and crawfish. Production levels of the aquacultural sector have grown substantially during the last decade. Except for the establishment of The Catfish Institute, however, little work has been done to assist industry planners in developing effective marketing programs. This lack of knowledge is a formidable barrier to market expansion and stability.

The Southern Regional Aquaculture Center (SRAC) identified the lack of market information as a critical industry need. In 1988, in recognition of this need, SRAC commissioned a project involving researchers from Alabama, Arkansas, Louisiana, Mississippi, South Carolina, and Texas (Hatch, 1988). The overall goal of this project was to gather information to facilitate the expansion of markets for catfish and crawfish produced in the southern region.

National surveys of 3,600 consumers, 1,800 retail grocery managers, and 1,800 restaurant managers were conducted from April 1988 to June 1988. The principal aims of these surveys were threefold: (1) to identify socio-economic effects on household consumption patterns of catfish and crawfish (McGee et al., 1989); (2) to identify factors associated with the handling of catfish and crawfish by retail grocery outlets; and (3) to identify factors affecting the handling of catfish and crawfish by full-service restaurants.

Recently, the fastest growing segment of the seafood industry is the retail food sector, particularly grocery stores. In 1987, seafood sales were $17.8 billion, 5.7 percent of total grocery store sales ($313 billion). Catfish is the leading aquacultural product in the United States. Sales of catfish were nearly $150 million in 1988 (Engle et al., 1988). This research analyzes catfish and crawfish products at the retail grocer level. Specifically, the objectives are twofold: (1) to evaluate marketable product forms of catfish and crawfish sold in supermarkets through the use of scanner data; and (2) to estimate retail demand relationships for catfish and crawfish. The source of data for the analyses in this study is from a retail food firm in Houston, Texas. This analysis lies within the boundaries of the traditional catfish and crawfish markets. According to McGee et al. (1989), the south-central region of the United States consumes approximately 45 percent of all catfish. The time frame analyzed is the period from January 1987 to November 1988. This research directly benefits not only the SRAC but also food retailers, especially given the recent proliferation of seafood delicatessens.

Our work complements the national surveys commissioned by the SRAC. The focus, however, is only on a local up-scale market in Houston. Previous studies that deal with influences on retail grocery demand for catfish or crawfish are few. Engle et al. (1988) conducted a survey to profile prices and quantities sold of the most important seafood products at the retail grocer level in a 13-county area in east-central Alabama and west-central Georgia. No attempt, however, was made to estimate retail demand functions for the specific types of seafood products. Raulerson and Trotter (1973) conducted a market experiment in six Atlanta grocery stores to determine the demand for commercially raised catfish during a 2-month period in 1972. Price elasticities for catfish ranged from -1.23 to -8.93.

Our analysis builds on the work of Engle et al. (1988) as well as on the work of Raulerson and Trotter (1973). Emphasis is on estimating price elasticities and advertisement elasticities for individual catfish and crawfish products at the retail grocer level. The analysis in this research is similar to the work by Capps (1989) that examined retail demand relationships for steak, ground beef, roast beef, chicken, pork chops, ham, and pork loin.

Nature of Scanner Data

This research rests on the collection, organization, and use of scanner data from a retail food firm in Houston. Data on a weekly basis are from the period January 1987 to November 1988 (97 weeks). Scanner data constitute a readily available source of product-specific information. Such data not only permit analysis of demand for disaggregate commodities but also represent *current* market conditions.

Traditional demand analysis has generally depended upon aggregate annual, quarterly, or monthly time-series data of purchases and prices. These data often do not represent current market conditions and typically are too general for product-specific decision making. Time-series data from conventional secondary sources, in short, typically lack disaggregate product and price detail. Panels and surveys provide more detailed data for specific products as well as socio-demographic information but are expensive methods of data collection. Generally, a key limitation of panels or surveys is the lack of price information. Prices must be imputed from reported quantity and expenditure figures. Analysts may question the use of such imputations, particularly the estimation of cross-sectional demand functions (Cox and Wohlgenant, 1986). Another key limitation of the use of surveys (not necessarily panels) is the lack of time continuity. To illustrate, the United States Department of Agriculture sponsors the Nationwide Food Consumption Survey (NFCS). Since its inception in 1936, this survey takes place only once approximately every 10 years (e.g., 1965-66, 1977-78, 1987-88).

Scanner data, on the other hand, constitute a readily available, current, and timely source of product-specific

information. To quote Tomek (1985), "existing secondary data seem especially inadequate for studying product demand in retail markets, and fundamental work needs to be done to obtain relevant data" (pp. 913-914). "The data associated with computerized checkout systems in grocery stores could become an important source of information for studying retail demand" (p. 913).

Scanner data are not without limitations, however. Because of problems of data integrity and of too much detail creating "data overload," empirical practitioners have been less than enthusiastic about the value of scanner data in market research. Each *week* as few as 10 to 20 supermarkets will generate the equivalent amount of data as would a panel of 10,000 households. Consequently, considerable resources are necessary to reduce the mass of data to useful summary figures for demand analysis purposes.

Despite the volume of price, quantity, and expenditure information, scanner data, at least from retail food firms, typically lack the dimension of consumer socio-demographic data. To circumvent this problem, several firms currently issue customer identification cards (e.g., HEB food stores, personal communication) from which these firms obtain socio-demographic information essential to the derivation of income elasticities. For demand analyses based on scanner data from supermarkets, the common experimental unit is the individual food firm (aggregation over consumers), not the individual consumer. This aggregation problem is not necessarily negligible. If the food firm caters to a more or less homogeneous group of consumers, however, this aggregation problem is of little consequence.

Despite the sheer volume of information, scanner data files need to be augmented with information pertaining to advertising or promotional activities. Competitors' actions are also important but are extremely difficult to anticipate, measure, and evaluate. Analogously, it is difficult to represent nonprice effects (merchandising schemes, coupons, services, cleanliness, product selection, and reputation for fresh meat or produce). Consequently, the all-other-things-held-constant assumption may fail with the use of scanner data.

Food stores supplying the data for meat, poultry, and fish items as well as for produce must have the equipment to generate labels enabling the products to be electronically scanned. This equipment is expensive, sensitive, and may not always produce scannable labels. Because of the inability of particular food stores to scan such items, some scanner data for meat, poultry, fish, or produce may not be available or reliable.

In regard to data integrity, food industry observer Richard E. Shulman makes this point: ". . . caveat about scanning data: It's not accurate. It is representative. Don't expect the scanner to capture 100 percent of all sales. There are dozens of reasons that sales are "lost": bad symbols, poorly trained checkers, etc. The important thing to understand is that most sales will be captured and the resulting data can be acted upon" (National Grocers Association Technology Newsletter, 1985).

Lesser and Smith (1986) point out that scanner data misrepresent item movement (quantity purchased) if the scanning file is not rigorously maintained, if the items cannot be or are not scanned, or if Universal Product Codes (UPCs) are not entered manually. Furthermore, scanner data may not provide accurate information if stock shrink accounts for a substantial portion of the movement of a product. Because stock shrink generally contributes approximately 1 to 2 percent of supermarket sales, this factor should not be a major issue for the vast range of products. The integrity of the data is therefore a function of the level of discipline of the retail firm in capturing accurate information.

Along this line, Lesser and Smith (1986) conducted a study to evaluate the accuracy of scanner data. Their results suggested that "substantial error is possible when examining individual items on a weekly basis. This factor should be considered when using scanner data" (p. 71).

Scanner data from supermarkets in a particular location (for this analysis Houston) presumably represent a "controlled" experimental situation. The community-specific results, however, may not contribute to defensible, broad regional or nationwide inferences. Because of this potential limitation, the results of local analyses should be used not on a stand-alone basis but as supporting evidence in conjunction with a research approach designed to conduct demand analyses with scanner data on a national or regional basis.

Data Source

The source of data for the analyses in this study is a retail food firm in Houston. The time frame is from January 1987 to November 1988 (Table 1). Weekly observations began on Wednesday and ended on Tuesday to conform to store sales and advertising patterns. The number of supermarkets in operation by this firm over this time interval was 43. Importantly, the retail food firm in this study caters to relatively high-income customers, roughly 40 percent of whom have annual incomes in excess of $60,000 per household.

The number of finfish and shellfish species sold in this retail firm over the period January 1987 to November 1988 was 448. Of the 448 species, 6 were catfish species, and 3 were crawfish species (Table 2).

Scanner data are available on a daily basis. Aggregation of daily information into weekly information

Table 1. Documentation of the weeks for the scanner project, January 1987 to November 1988.

1987				1988			
Week no.	Week ending date	Week no.	Week ending date	Week no.	Week ending date	Week no.	Week ending date
1	113	27	714	52	105	75	614
2	120	28	721	53	112	76	621
3	127	29	728	54	119	77	628
4	203	30	804	55	126	78	705
5	210	31	811	56	202	79	712
6	217	32	818	57	209	80	719
7	224	33	825	58	216	81	726
8	303	34	901	59	223	82	802
9	310	35	908	60	301	83	809
10	317	36	915	61	308	84	816
11	324	37	922	62	315	85	823
12	331	38	929	63	322	86	830
13	407	39	1006	64	329	87	906
14	414	40	1013	65	405	88	913
15	421	41	1020	66	412	89	920
16	428	42	1027	67	419	90	927
17	505	43	1103	68	426	91	1004
18	512	44	1117	69	502	92	1011
19	519	45	1117	70	509	93	1018
20	526	46	1124	71	516	94	1025
21	602	47	1201	72	523	95	1101
22	609	48	1208	73	530	96	1108
23	616	49	1215	74	607	97	1115
24	623	50	1222				
25	630	51	1229				
26	707						

Table 2. Universal product codes (UPCs) for catfish and crawfish products.

UPC	Description	Number of observations
1116211186	Mrs. Paul's Catfish Strips[a]	87
3760015151	Hormel Catfish Fillets[a]	97
3760042214	Hormel Catfish Bobber Snacks[a]	46
20607400000	Fresh whole catfish[b]	97
20608100000	Fresh farm-raised catfish fillets[b]	97
20614000000	Fresh ocean catfish fillets[b]	97
1830012021	Cajun Cook Crawfish Etouffe with Rice[a]	97
20608000000	Fresh cooked crawfish[b]	84
20613600000	Frozen cooked crawfish meat[b]	39

[a]Convenience (processed) item – prepared entree.
[b]Fresh item.

makes computations more manageable. This weekly information also allows for better representation of supermarket operations. To clarify, price changes are usually initiated once per week, and merchandising activities such as newspaper advertisements and displays are also usually done weekly (Carmen and Figuroa, 1986).

This study is based on point-of-sale purchases. For each product, movement (in pounds) and price (in cents/pound) are reported by week. For commodity aggregates (fresh catfish, fresh crawfish), convenience (processed) catfish, and convenience (processed) crawfish, the quantities of the various items correspond to the sum of the respective quantities of the relevant UPCs. Implicit prices of the commodity aggregates are weighted averages of all individual UPC prices. The weighting mechanism is the ratio of the sum of all sales over the UPCs to the sum of all quantities.

Quality affects may result from such commodity aggregation (Houthakker, 1952; Cox and Wohlgenant, 1986). When distinct items are aggregated into commodity groups, variations occur in the implicit prices. Furthermore, the weighted average prices change with the quantities of the component goods consumed. Although the use of implicit prices potentially limits the analysis, given that the aquacultural products in question are relatively homogeneous, quality effects attributable to commodity aggregation are assumed to be negligible.

Emphasis in this study is on demand relationships at the firm level in lieu of the store level. The prices for each UPC are the same across the supermarkets studied, and sales of meat items at the stores are reasonably similar. Hence, data from all supermarkets in the firm are aggregated to form 97 weekly time-series observations.

Conceptual Framework for the Analysis

Holdren (1960, pp. 117-123) provides the conceptual framework for this analysis. Attention is on multiproduct retail demand functions. According to Holdren (1960, p. 123)," the multiple product retail demand function can be characterized by

$$q_i = f_i (p_1, p_2, \ldots, p_n, a_1, a_2, \ldots, a_m). \quad (1)$$

where the q's represent quantity variables expressed in appropriate units, the p's represent price variables, and the a's represent attributes of the retailer's non-price offer variation." Advertising, sales promotion activities, hours open, and customer services are concrete examples of non-price offer variation. Seasonality also may affect the quantity variables, all other things held constant (Carmen and Figueroa, 1986). Because they are proxies for tastes and preferences of the collection of consumers who frequent retail stores, the sociodemographic influences in retail demand functions must be considered as well.

In light of the previous discussion, the specification for the demand models in this study is as follows:

$$Q_{it} = f(P_{it}, P_{jt}, \text{SEASON}, ADV_{it}, ADV_{jt}) \quad (2)$$

where Q_{it} is purchases per 1,000 customers (in pounds [fresh items] or in units (convenience [processed] items) of catfish or crawfish item i in week t, t = 1, . . ., 97; P_{it} is price of catfish or crawfish product i in week t (cents/pound); P_{jt} corresponds to a vector of prices of competing products (j refers to the set of competing products) in week t (cents/pound); SEASON corresponds to a set of monthly binary variables to measure seasonality; ADV_{it} corresponds to the amount of print space given for catfish or crawfish product i in the weekly advertisement flier (square centimeters); and ADV_{jt} corresponds to the amount of print space given for the set of competing products in the weekly advertisement flier (square centimeters).

Data corresponding to purchases are converted to a per customer basis. Consequently, the dependent variables reflect purchases per 1,000 customers. Because of unavailability of information, the model specification excludes competitors' prices and advertising as well as socio-demographic variables.

The variables P_{it} and P_{jt} capture own-price and cross-price effects. Own-price effects are hypothesized to be negative. Cross-price effects may be negative or positive to reflect substitutable or complementary relationships among the commodities in question. For disaggregate analyses, the identification of appropriate substitutes or complements *a priori* is a difficult task. Cheng and Capps (1988) suggest that the demand for finfish and shellfish depends upon poultry, pork, and beef prices. In this study, such prices correspond to weighted average prices of poultry, pork, and beef products. Weighted average prices of finfish and shellfish products are also included in the model specification. Specifically, in the demand relationships for catfish products, the weighted average price of finfish items, excluding catfish, is used as a regressor as well as the weighted average price of shellfish items. Similarly, in the demand relationships for crawfish, the weighted average price of shellfish items, excluding crawfish, is used as a regressor along with the weighted average price of finfish items.

Because data are only from a single firm, some may argue from the following rationale that price elasticities are not estimable: (1) consumers can respond to price changes by shopping at different stores within a market area, and (2) no information in this study is available on their purchases at other stores or on the prices charged at other stores. According to the Food Marketing Institute, however, only 27 percent of shoppers compare prices from store to store (Cox and Foster, 1985). Consequently, it is possible to estimate price elasticities. Additionally, multicollinearity between competitor's prices and in-store prices may be too strong to allow for measurement of the separate effects of the variables (Funk, et al., 1977). Therefore, in this study, the omission of competitors' prices may not be a limiting factor in estimating in-store price elasticities.

Local newspaper advertising is the only advertising mode considered in our study. Although television, radio, and in-store displays are used by the chain, these forms are primarily oriented toward creating a favorable corporate image (personal communication with the retail firm). Newspaper advertising (the weekly advertisement flier of the firm), on the other hand, is geared primarily to promoting specific products. The basic format and design of the newspaper advertisements used by the chain were the same throughout the period. Therefore no measure of "creative aspects" of advertising is necessary. In this study, advertising data refer to the amount of print space devoted to each item, measured in square centimeters.

This study allows the examination of own- and cross-advertisement effects. All other things held constant, own-advertisement effects are hypothesized to be positive, whereas cross-advertisement effects are hypothesized to be negative. The respective set of advertisement variables used in the retail demand relationships corresponds precisely to the set of price variables previously discussed. Competitors' advertising is excluded because of resource constraints.

Data Description

This section deals with three components: (1) data for individual UPCs, (2) documentation of customer counts by week, and (3) documentation of advertisement space for catfish and crawfish products. Pulling together price/quantity information on individual UPCs, customer counts, and advertisement space was an exacting task.

Individual UPCs

Price and quantity information are not necessarily available for all UPCs for *all* 97 weeks (Table 2). For example, Mrs. Paul's Catfish Strips, Hormel Catfish Bobber Snacks, fresh cooked crawfish, and frozen cooked crawfish meat were available at week 1 of the analysis but eventually were discontinued by the retail firm.

The various catfish and crawfish items correspond to either fresh or convenience (processed) products. The three convenience catfish products and corresponding UPCs are prepared entrees (the numbers in parentheses are the actual UPCs): (1) Mrs. Paul's Catfish Strips (1116211186), (2) Hormel Catfish Fillets (3760015151), and (3) Hormel Catfish Bobber Snacks (3760042214). The three fresh catfish products are (1) fresh whole catfish (20607400000), (2) fresh farm-raised catfish fillets (20608100000), and (3) fresh ocean catfish fillets (20614000000). The single convenience crawfish

product is Cajun Cook Crawfish Etouffe with Rice (1830012021); the two fresh crawfish products are (1) fresh cooked crawfish (20608000000) and (2) frozen cooked crawfish meat (20613600000). This analysis also considers aggregate products, namely fresh catfish, convenience (processed) catfish (prepared entrees), and fresh crawfish.

Customer Counts

Figure 1 plots customer counts, which per week for the retail firm under study ranged from 577,428 to 861,844 over the time frame. The average customer count was 724,070.

Advertisement Space

Information on customer counts and advertisement space must be *augmented* to the price and quantity information of the individual UPCs. That is, data pertaining to advertisement space and customer counts are not automatically part of the scanner data pertaining to the individual UPCs collected at the point of sale.

Advertisement space (in terms of square centimeters) for the respective aquacultural products varied considerably from week to week (Figs. 2 and 3). Descriptive statistics of advertisement variables are exhibited in Table 3. On the basis of print space, catfish averaged almost 27 square centimeters. In comparison, crawfish received slightly more than 1 square centimeter of print space on average. Advertisements of catfish occurred 48 times over the 97 week span, while advertisements of crawfish occurred only once. The combination of all remaining shellfish products received roughy 57 square centimeters of print space on average; the frequency of such advertisements is 70 of 97 weeks. Additionally, the combination of all remaining finfish products received an average of nearly 92 square centimeters of print space. The frequency of such advertisements is 77 out of 97 weeks. The share of shellfish advertisements for crawfish is roughly 0.3 percent, whereas the share of finfish advertisement space for catfish is 26.0 percent. The principal shellfish product in terms of print space and advertisement frequency is shrimp; the principal finfish product in terms of print space and advertisement frequency is catfish.

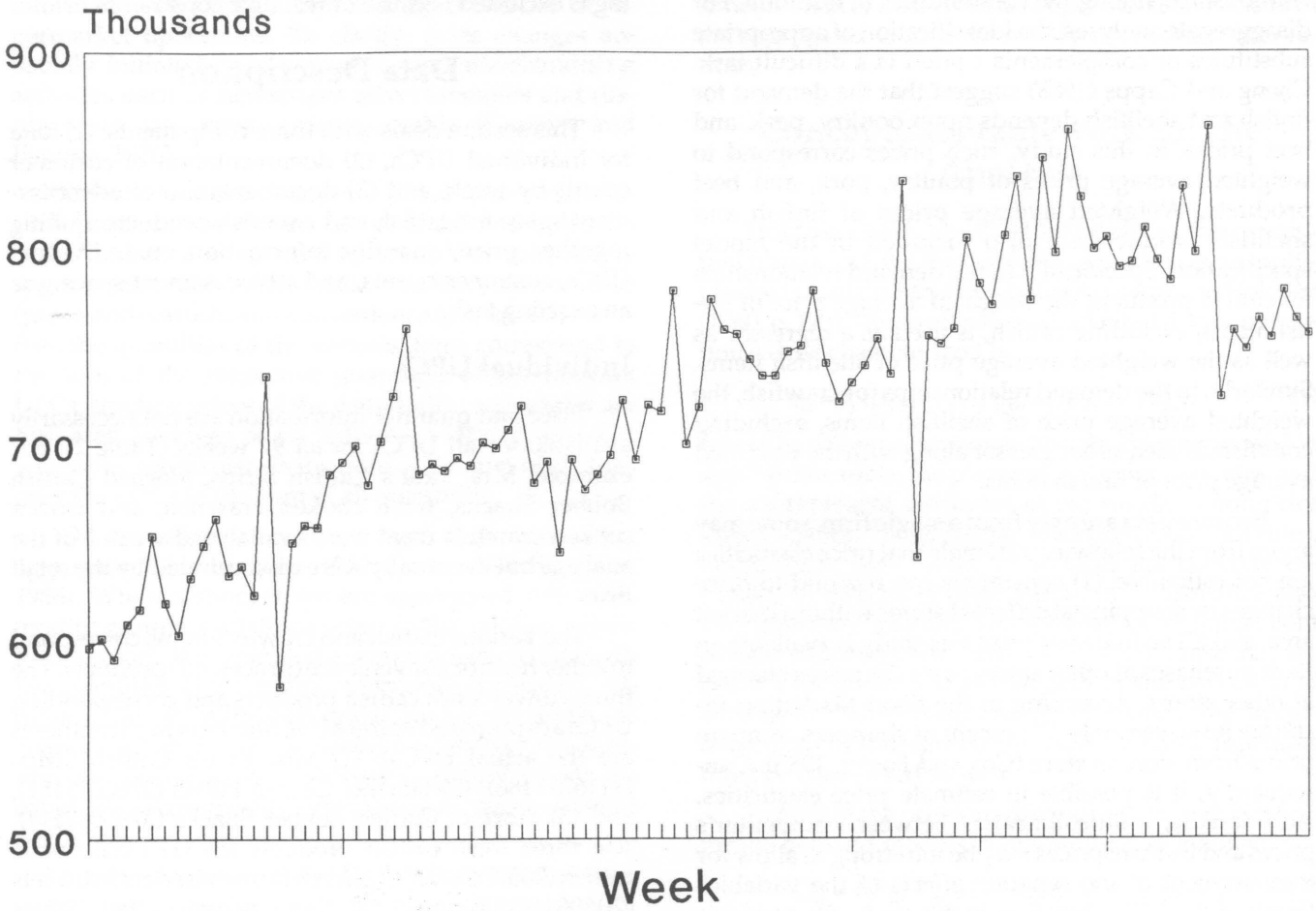

Figure 1. Customer counts.

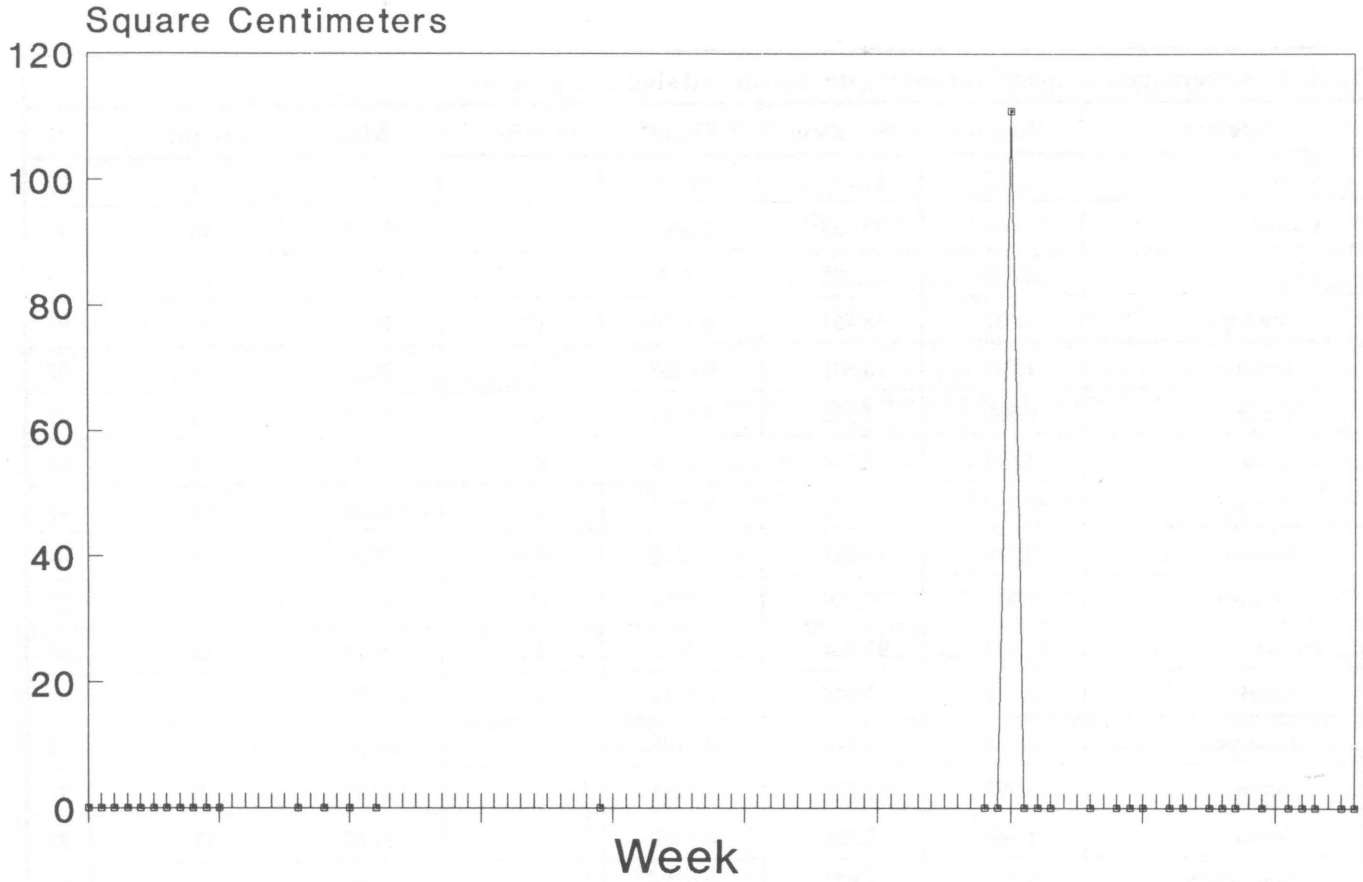

Figure 2. Advertisement space for crawfish.

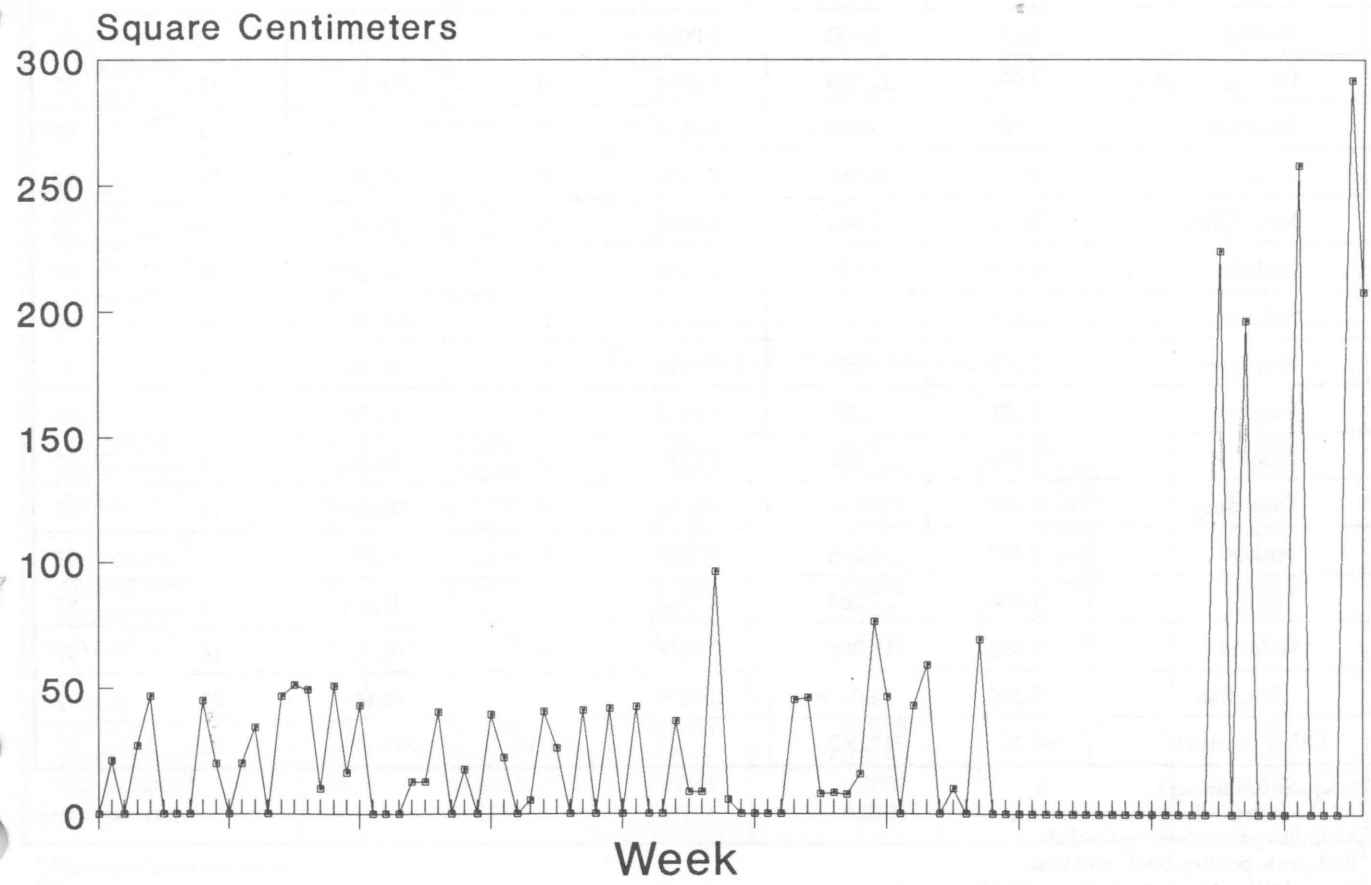

Figure 3. Advertisement space for catfish.

Table 3. Advertisement space[a] for aggregate finfish and shellfish products.							
Species	Mean	St. Dev.	Share[e]	Min.	Max.	Frequency	N
Crawfish	1.142	11.255	0.0028	0	110.85	1	97
Catfish	26.699	53.853	0.2603	0	291.58	48	97
Shellfish[b]	56.676	73.988	NA	0	442.02	70	97
Scallops	3.837	8.464	0.1176	0	45.00	24	97
Lobster	1.719	10.501	0.0258	0	94.20	5	97
Clams	0.820	3.592	0.0287	0	21.75	6	97
Crab	1.633	7.996	0.0349	0	54.37	6	97
Shrimp	46.330	72.474	0.7014	0	412.02	64	97
Mussels	0.398	2.021	0.0132	0	13.00	4	97
Oysters	1.936	5.059	0.0724	0	30.60	15	97
Finfish[c]	91.594	93.904	NA	0	399.78	77	97
Shark	6.611	18.396	0.0641	0	955.55	25	97
Grouper	1.528	7.326	0.0125	0	50.70	6	97
Perch	3.993	21.723	0.0214	0	198.38	8	97
Scrod	1.540	5.526	0.0209	0	44.40	11	97
Swordfish	2.535	16.822	0.0231	0	164.00	9	97
Mackerel	0.147	1.451	0.0015	0	14.30	1	97
Redfish	0.477	3.992	0.0065	0	38.64	2	97
Orange roughy	4.897	22.048	0.0524	0	201.69	15	97
Rockfish	2.902	9.330	0.0287	0	77.76	17	97
Tuna	22.019	49.982	0.1276	0	247.86	24	97
Mahi-Mahi	0.713	2.864	0.0074	0	15.96	6	97
Pollock	4.579	12.130	0.0549	0	94.40	25	97
Salmon	20.836	55.163	0.1355	0	291.20	24	97
Flounder	2.070	6.439	0.0226	0	39.00	13	97
Snapper	0.396	2.236	0.0132	0	13.50	3	97
Bluefish	1.202	7.108	0.0119	0	55.25	4	97
Oreo dory	4.959	23.160	0.0356	0	193.60	11	97
Turbot	0.423	4.166	0.0016	0	41.04	1	97
Trout	1.886	7.284	0.0266	0	45.60	8	97
Halibut	2.595	11.308	0.0228	0	105.00	14	97
Whitefish	5.276	14.017	0.0479	0	96.60	21	97
Other products[d]	996.10	312.062		340.04	1875.37	97	97

[a]In square centimeters.
[b]All shellfish products except crawfish.
[c]All finfish products except catfish.
[d]Beef, pork, poultry, lamb, and veal.
[e]Share of either finfish or shellfish advertisement space.

Finally, advertisements of beef, pork, poultry, lamb, and veal received roughly 1,000 square centimeters of print space per week. At least one of these products was advertised every week.

Statistical Procedures

This section deals with two components: (1) descriptive statistics of catfish and crawfish products; and (2) a layout of the econometric analysis.

Descriptive Statistics

Detailed descriptive statistics of purchases and prices for the catfish and crawfish products are exhibited in Tables 4 and 5. Descriptive statistics correspond to the mean, median, standard deviation, minimum, and maximum. The mean and median relate to measures of central tendency, the standard deviation corresponds to a measure of dispersion, and the minimum and maximum define the range of the data. In terms of item movement, the key fresh catfish product is fresh farm-raised catfish fillets; the least important fresh catfish product is fresh ocean catfish fillets. The major prepared entrees are Hormel Catfish Fillets and Mrs. Paul's Catfish Strips. The principal crawfish product was the prepared entree Cajun Cook Crawfish Etouffe with Rice. The major fresh crawfish product was fresh cooked crawfish. In terms of price, the most expensive catfish items, on average, were catfish fillets, either farm-raised or ocean catfish. The least expensive were Hormel Catfish Fillets and Bobber Snacks. The

Table 4. Descriptive statistics of purchases of catfish and crawfish species.

UPC code	N	Mean	Median	Standard deviation	Minimum	Maximum
Purchases						
Catfish						
1116211186[a]	87	131.56	149	57.78	1	223
3760015151[a]	97	219.94	216	56.46	96	543
3760042214[a]	46	84.23	87	47.67	1	274
Convenience catfish[a]	97	377.89	388	150.58	144	1030
20607400000[b]	97	804.76	597	560.84	228	2523
20608100000[b]	97	2826.2	2365	1113.84	1276	6751
20614000000[b]	97	12.70	5	32.47	0	276
Fresh catfish[b]	97	3643.66	3408	1103.43	1545	7282
Crawfish						
1830012021[a]	97	274.25	274	72.71	129	504
20608000000[b]	84	17.20	16	12.42	0	57
20613600000[b]	39	2.84	3	1.98	0	7
Fresh crawfish[b]	97	16.04	15	13.73	0	57
Purchases per 1,000 customers						
Catfish						
1116211186[a]	87	0.1898	0.2092	0.0915	0.0012	0.3693
3760015151[a]	97	0.3099	0.2999	0.1005	0.1264	0.8584
3760042214[a]	46	0.1284	0.1246	0.0774	0.0013	0.4331
Convenience catfish[a]	97	0.5411	0.5325	0.2573	0.1921	1.6283
20607400000[b]	97	1.1279	0.7857	0.8317	0.3002	3.6609
20608100000[b]	97	3.9326	3.2800	1.5685	1.6805	8.8272
20614000000[b]	97	0.0172	0.0062	0.0451	0	0.3940
Fresh catfish[b]	97	5.0778	4.5341	1.5935	2.0348	9.5215
Crawfish						
1830012021[a]	97	0.3766	0.3753	0.0848	0.1699	0.6591
20608000000[b]	84	0.0248	0.0218	0.0190	0	0.0954
20613600000[b]	39	0.0042	0.0043	0.0030	0	0.0102
Fresh crawfish[b]	97	0.0232	0.0191	0.0201	0	0.095

[a] Purchases in terms of units.
[b] Purchases in terms of pounds.

Table 5. Descriptive statistics of prices of catfish and crawfish species as well as prices of meat, poultry, and fish.

UPC code	N	Mean	Median	Standard deviation	Minimum	Maximum
Catfish						
1116211186[a]	87	333.00	333.00	0.00	333.00	333.00
3760015151[a]	97	258.13	259.00	11.64	217.00	268.00
3760042214[a]	46	255.54	259.00	8.42	217.00	259.00
Convenience catfish[a]	97	279.71	280.26	11.55	240.98	298.38
20607400000[b]	97	264.12	269.00	30.32	199.00	299.00
20608100000[b]	97	421.40	429.00	38.57	344.00	469.00
20614000000[b]	97	556.89	499.00	87.08	459.00	798.00
Fresh catfish[b]	97	382.41	395.11	38.30	295.56	440.66
Crawfish						
1830012021[a]	97	300.02	289.00	32.72	267.00	369.00
20608000000[b]	84	443.52	449.00	8.97	429.00	449.00
20613600000[b]	39	1138.64	999.00	179.46	999.00	1398.00
Fresh crawfish[b]	77	484.58	449.00	58.82	429.00	671.10
Meat, poultry, and fish prices[b]						
PPORK	97	290.84	293.19	27.43	204.09	363.60
PPOULT	97	169.50	172.75	27.74	91.68	218.76
PBEEF	97	246.70	253.61	24.36	196.37	282.55
PSHELL[c]	97	611.07	605.94	107.71	410.56	800.63
PFIN[d]	97	489.32	493.95	34.87	382.28	567.92

[a] Price in terms of cents/unit.
[b] Price in terms of cents/pound.
[c] Weighted average price of fresh shellfish species, excluding crawfish.
[d] Weighted average price of fresh finfish species, excluding catfish.

most expensive crawfish item was frozen cooked crawfish meat, and the least expensive crawfish item was Cajun Cook Crawfish Etouffe with Rice. Fresh catfish and crawfish products were more costly on a per unit basis than were convenience counterparts.

Weighted average prices of fresh pork, poultry, and beef at this firm respectively averaged $2.90, $1.69, and $2.46 per pound. These prices were lower than those for fresh catfish ($3.82 per pound) and fresh crawfish ($4.84 per pound). Weighted average prices for finfish and shellfish at the retail firm were $4.89 and $6.11 per pound on average, respectively.

Average dollar sales and average budget shares per week for catfish and crawfish products are exhibited in Table 6. Budget shares represent the proportion of sales attributable to individual products. Catfish products contributed $15,061 weekly in sales, while crawfish products constituted $937 weekly in sales at this retail firm. Fresh catfish products constituted roughly 90 percent of all catfish sales, and produced $13,571 in sales per week. The principal fresh catfish products were fresh farm-raised catfish fillets and fresh whole catfish. Convenience catfish products generated roughly $1,500 in sales per week, about 10 percent of all catfish sales. The key convenience catfish products in terms of dollar sales were Hormel Catfish Bobber Snacks and Mrs. Paul's Catfish Strips.

This set of characteristics of catfish sales is similar to the national study of McGee et al. (1989). In the national study, the most preferred product forms of catfish were fresh fillets followed by fresh whole-dressed fish. The product form least preferred was prepared entrees.

Convenience crawfish products constituted $789 weekly in sales, approximately 84 percent of all crawfish sales. Fresh crawfish products constituted the remaining 16 percent. The principal fresh crawfish product was fresh cooked crawfish meat.

Graphs corresponding to movement (purchases) over time for each of the catfish and crawfish products are exhibited in Figures 4 - 15. Graphs corresponding to prices over time for each of the catfish and crawfish products are exhibited in the Appendix. The graphs summarize more clearly the variability in item movement and in price on a week-to-week basis. With few exceptions, movement varied tremendously per week.

Table 6. Average dollar sales and average budget shares per week for catfish and crawfish products.		
Category	**Average dollar sales/week**	**Average budget share**
All catfish products	15,061	
Convenience catfish	1,488	0.0988
UPC 1116211186	602	0.0400
UPC 3760015151	653	0.0434
UPC 3760042214	230	0.0153
Fresh catfish	13,571	0.9011
UPC 20607400000	2,020	0.1341
UPC 20608100000	11,523	0.7651
UPC 20614000000	27	0.0018
All crawfish products	937	
Convenience crawfish	789	0.8417
UPC 1830012021		
Fresh crawfish	148	0.1582
UPC 20608000000	36	0.0386
UPC 20613600000	112	0.1196

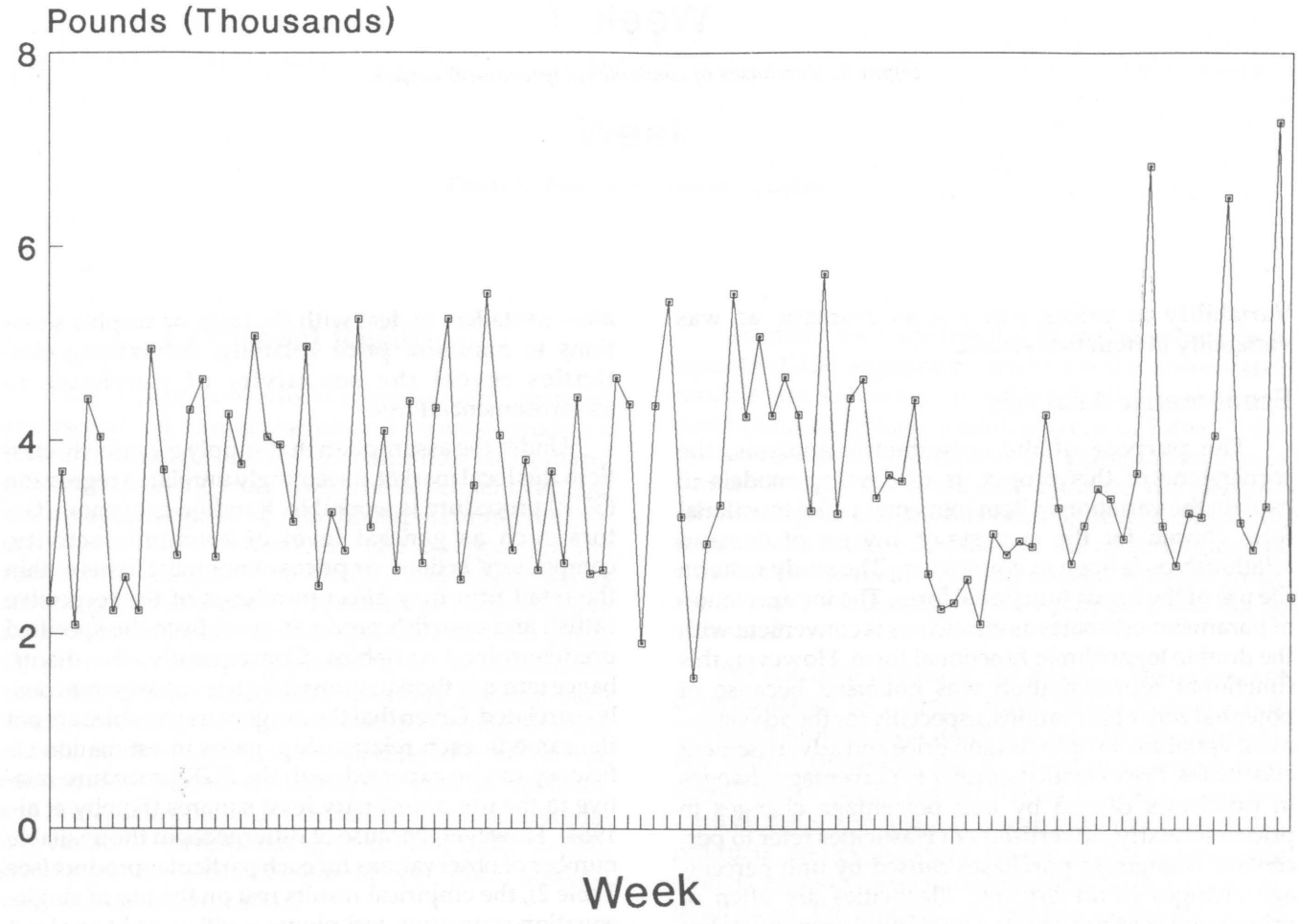

Figure 4. Purchases of fresh catfish.

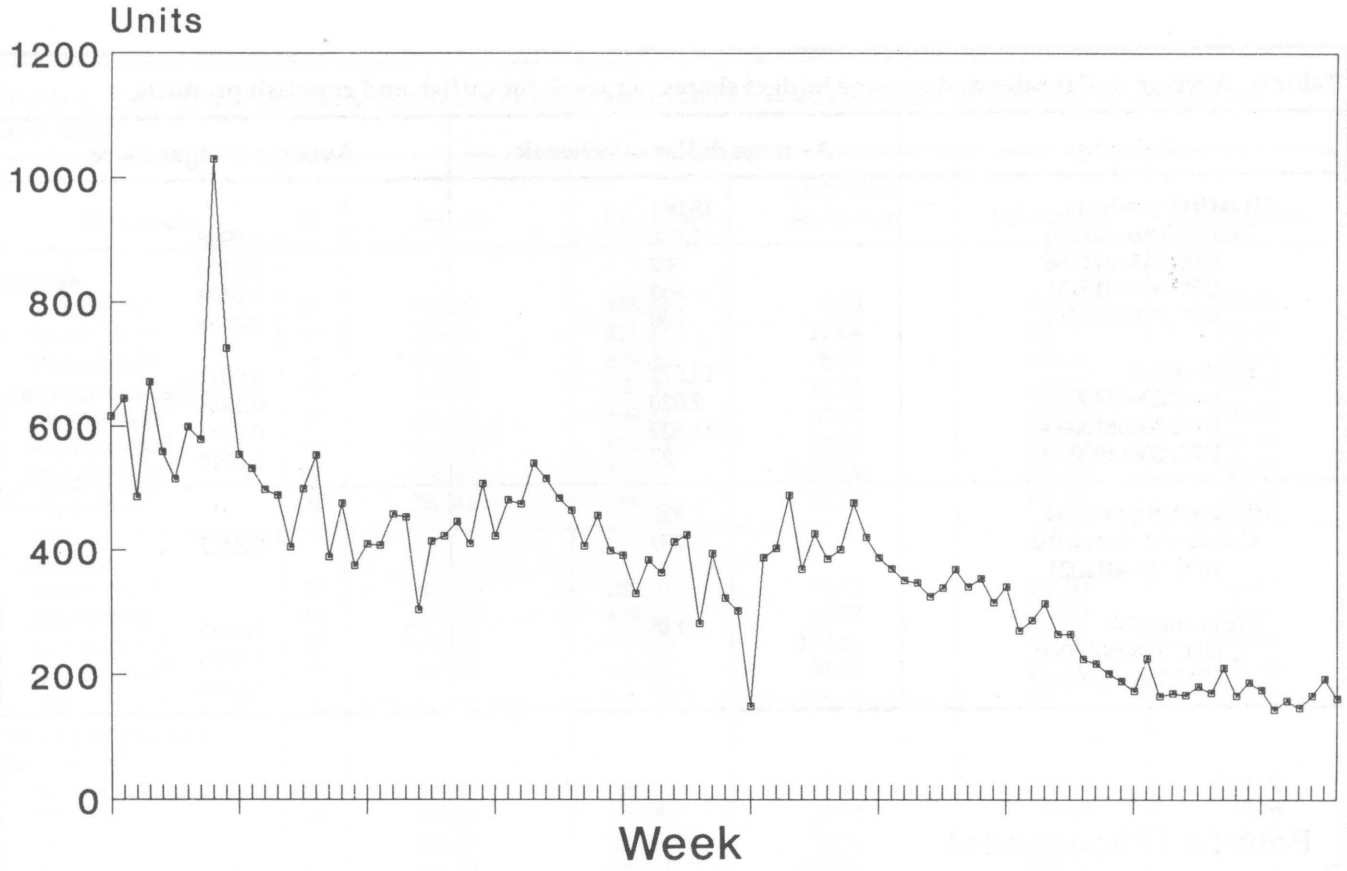

Figure 5. Purchases of convenience (processed) catfish.

Variability in prices was not as dramatic as was variability in item movement.

Econometric Analysis

The purpose of the econometric analysis, the cornerstone of this project, is to develop models to explain the variation in item movement. The functional form chosen for the analysis of any set of demand relationships is open to empiricism. The study rests on the use of the linear functional form. The interpretation of parameter estimates as elasticities is convenient with the double logarithmic functional form. However, this functional representation was not used because of potential zero observations, especially for the advertisement variables. Emphasis is on price and advertisement elasticities. Price elasticities refer to percentage changes in purchases caused by *unit* percentage changes in prices; similarly, advertisement elasticities refer to percentage changes in purchases caused by unit percentage changes in advertising. Elasticities are often of primary interest not only to agricultural economists but also to food retailers. Knowledge of price elasticities allows retailers to deal with shortage or surplus situations to minimize price volatility. Advertising elasticities reveal the sensitivity of purchases to advertisement efforts.

Under the assumption that supply is perfectly elastic in this local market, a seemingly unrelated regression (SUR) procedure is workable. Random exogenous factors such as general level of economic activity, competitors' actions, or prices of nonmeat items within the retail firm may affect purchases of the respective catfish and crawfish products apart from the specified predetermined variables. Consequently, the disturbance terms of the equations may be contemporaneously correlated. Given that the exogenous variables are not the same in each relationship, gains in estimation efficiency can be expected with the SUR procedure relative to the use of ordinary least squares (Fomby et al., 1984). However, because of differences in the available number of observations for each particular product (see Table 2), the empirical results rest on the use of single-equation estimation techniques – either ordinary least squares or generalized least squares.

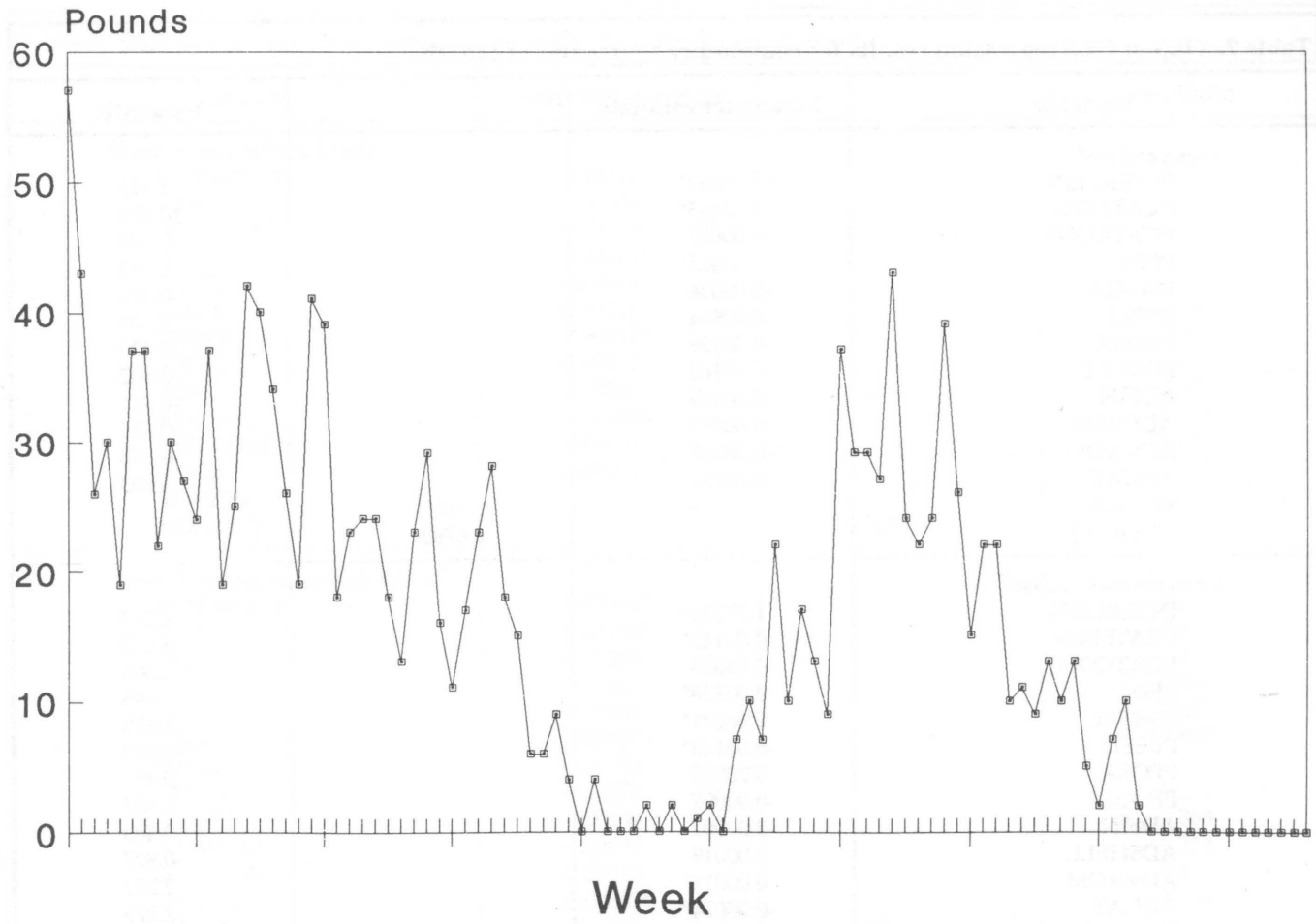

Figure 6. Purchases of fresh crawfish.

Empirical Results

This section concerns the econometric demand analyses for the various catfish and crawfish products. The econometric model corresponds to demand relationships at the retail level. The dependent variable in the respective demand relationships is units of movement per 1,000 customers. The purpose of the econometric analysis is to identify and assess factors affecting purchases per 1,000 customers. The respective exogenous (independent) variables are (1) own-price, (2) prices of competing products, (3) advertisement variables, and (4) seasonality (monthly dummy variables). For example, in the econometric model for fresh catfish, price variables corresponding to fresh catfish, convenience (processed) catfish, other finfish, shellfish, and beef, pork, poultry are included. As well, advertising variables corresponding to catfish, other finfish, shellfish, and the combination of beef, pork, poultry, veal, and lamb are included.

Ordinary least squares (OLS) or generalized least squares (GLS) regression results for the econometric models are exhibited in Tables 7–10. The list and description of variable names is given in Table 11. Because of a lack of variation in the price of Mrs. Paul's Catfish Strips, we could not estimate the demand relationship for this product (see Figure A. 4). Similarly, because of a lack of variation in the advertisement of crawfish in the form of frozen cooked crawfish meat, the demand relationship for this product could not be estimated.

For crawfish products, the adjusted coefficients of determination ($\bar{R}^2$) range from 0.4413 (Cajun Cook Crawfish Etouffe with Rice) to 0.5465 (fresh crawfish). For catfish products, the $\bar{R}^2$ measures ranged from 0.5693 (fresh ocean catfish fillets) to 0.9239 (Hormel Catfish Bobber Snacks). For both crawfish and catfish products, the explanatory power of the econometric models generally was on the order of 50 to 70 percent. In all cases, the amount of variation explained by the models was statistically significant. On the basis of

Table 7. OLS or GLS regression results for commodity aggregates of catfish.			
Variable	**Parameter estimate**		**t-statistic**
Fresh catfish[a]			
INTERCEPT	13.10832*		3.543
PCATFRES	-0.02865*		-10.028
PCATCONV	-0.00623		-0.709
PFIN	0.00625*		1.892
PSHELL	-0.00036		-0.390
PBEEF	0.00614		1.209
PPORK	-0.00196		-0.420
PPOULT	-0.00162		-0.402
ADFIN	-0.00109		-0.911
ADSHELL	-0.00012		-0.088
ADVAOM	-0.00006		-0.168
ADCAT	0.01037*		4.903
SEASON		1.999*[c]	
ADJ R-SQ		0.6762	
Convenience catfish[b]			
INTERCEPT	1.37236*		2.273
PCATFRES	-0.00142*		-3.170
PCATCONV	-0.00055		-0.365
PFIN	-0.00138*		-2.646
PSHELL	0.00101*		6.678
PBEEF	-0.00145*		-1.898
PPORK	0.00065		0.951
PPOULT	-0.00097		-1.603
ADFIN	-0.00007		-0.403
ADSHELL	-0.00019		-0.927
ADVAOM	0.00011*		2.233
ADCAT	-0.00074*		-2.279
SEASON		6.219*[a]	
DURBIN-WATSON DW		1.773	
ADJ R-SQ		0.6971	

* Statistically significant at the 0.05 level.
[a] GLS estimates to circumvent serial correlation problems.
[b] OLS estimates.
[c] F-statistic.

Table 8. OLS or GLS regression results for individual fresh catfish products.

Variable	Parameter estimate		t-statistic
Fresh ocean catfish fillets[a]			
INTERCEPT	0.39352*		2.706
P206140	-0.00004		-0.722
PCATCONV	-0.00058*		-1.830
PFIN	0.00019*		1.665
PSHELL	0.00004		1.034
PBEEF	-0.00011		-0.648
PPORK	-0.00042*		-2.551
PPOULT	-0.00020		-1.457
ADFIN	-0.000005		-0.132
ADSHELL	0.000006		0.118
ADVAOM	-0.00001		-1.070
ADCAT	-0.00001		-0.212
SEASON		6.473*[c]	
ADJ R-SQ		0.5693	
Fresh farm-raised catfish fillets[b]			
INTERCEPT	15.97354*		4.280
P206081	-0.03100*		-11.405
PCATCONV	-0.01200		-1.309
PFIN	0.00415		1.361
PSHELL	-0.00135		-1.472
PBEEF	0.00695		1.487
PPORK	-0.00071		-0.173
PPOULT	0.00072		0.201
ADFIN	-0.00040		-0.368
ADSHELL	0.00026		0.213
ADVAOM	0.00013		0.417
ADCAT	0.00859*		4.356
SEASON		1.989*[c]	
DURBIN-WATSON DW		2.254	
ADJ R-SQ		0.7077	
Fresh whole catfish[b]			
INTERCEPT	9.98400*		4.513
P206074	-0.02582*		-11.503
PCATCONV	-0.00387		-0.704
PFIN	0.00088		0.468
PSHELL	-0.00208*		-3.710
PBEEF	0.00395		1.423
PPORK	-0.00450*		-1.772
PPOULT	0.00235		1.076
ADFIN	-0.00026		-0.388
ADSHELL	-0.00004		-0.058
ADVAOM	-0.00036*		-1.918
ADCAT	0.00065		0.571
SEASON		0.681[c]	
DURBIN-WATSON DW		2.309	
ADJ R-SQ		0.6214	

* Statistically significant at the 0.05 level.
[a] GLS estimates to circumvent serial correlation problems.
[b] OLS estimates.
[c] F-statistic.

Table 9. OLS or GLS regression results for individual convenience (processed) catfish products (prepared entrees).

Variable	Parameter estimate		t-statistic
Hormel Catfish Bobber Snacks[a]			
INTERCEPT	1.88256*		5.524
P3764	-0.00686*		-6.201
PCATFRES	-0.00020		-1.061
PFIN	-0.00005		-0.325
PSHELL	0.00013		1.383
PBEEF	-0.00047		-1.395
PPORK	0.00048		1.271
PPOULT	-0.00023		-0.741
ADFIN	0.00004		0.606
ADSHELL	-0.00042*		-1.714
ADVAOM	0.00002		0.800
ADCAT	0.00038		0.925
SEASON		5.479*[c]	
ADJ R-SQ		0.9239	
Hormel Catfish Fillets[b]			
INTERCEPT	1.32190*		4.650
P3761	-0.00327*		-3.710
PCATFRES	-0.00034		-1.623
PFIN	-0.00019		-0.535
PSHELL	-0.00030		-1.273
PBEEF	0.00014*		1.913
PPORK	0.00004		0.138
PPOULT	-0.00018		-0.666
ADFIN	-0.00001		-0.147
ADSHELL	-0.00002		-0.246
ADVAOM	0.00001		0.792
ADCAT	-0.00011		-0.817
SEASON		3.763*[c]	
DURBIN-WATSON DW		1.563	
ADJ R-SQ		0.5789	

* Statistically significant at the 0.05 level.
[a] GLS estimates to circumvent serial correlation problems.
[b] OLS estimates.
[c] F-statistic.

Table 10. OLS regression results for crawfish.			
Variable	**Parameter estimate**		**t-statistic**
Cajun Cook Crawfish Etouffe with Rice			
INTERCEPT	0.68921*		2.473
P183	-0.00102*		-2.629
PCRAFRES	-0.00008		-0.601
PFIN	0.00028		1.122
PSHELL	-0.00019*		-1.790
PBEEF	0.00028		0.732
PPORK	-0.00030		-0.854
PPOULT	0.00026		0.770
ADFIN	-0.000006		-0.076
ADSHELL	-0.00014		-0.906
ADVAOM	-0.00003		-1.477
ADCRAW	0.00060		0.721
SEASON		1.502[a]	
DURBIN-WATSON DW		1.769	
ADJ R-SQ		0.4413	
Fresh crawfish			
INTERCEPT	0.07830		1.294
PCRAFRES	-0.00004		-1.330
P183	0.00008		0.987
PFIN	-0.00011*		-1.960
PSHELL	0.00005*		2.246
PBEEF	-0.00018*		-2.230
PPORK	-0.00001		-0.196
PPOULT	-0.00004		-0.613
ADFIN	-0.00003*		-1.733
ADSHELL	-0.00004		-1.281
ADVAOM	0.000002		0.520
ADCRAW	-0.00001		-0.086
SEASON		2.241*[a]	
DURBIN-WATSON DW		1.491	
ADJ R-SQ		0.5465	
Fresh cooked crawfish			
INTERCEPT	0.08321		0.276
P206080	-0.00015		-0.276
P183	0.00009		0.572
PFIN	-0.00005		-1.034
PSHELL	0.00002		1.141
PBEEF	-0.00009		-1.197
PPORK	0.000001		0.014
PPOULT	0.00001		0.238
ADFIN	-0.00002		-1.261
ADSHELL	-0.00002		-0.637
ADVAOM	0.000001		0.202
ADCRAW	-0.00005		-0.305
SEASON		2.413*[a]	
DURBIN-WATSON DW		1.331	
ADJ R-SQ		0.4839	

* Statistically significant at the 0.05 level.
[a] F-statistic.

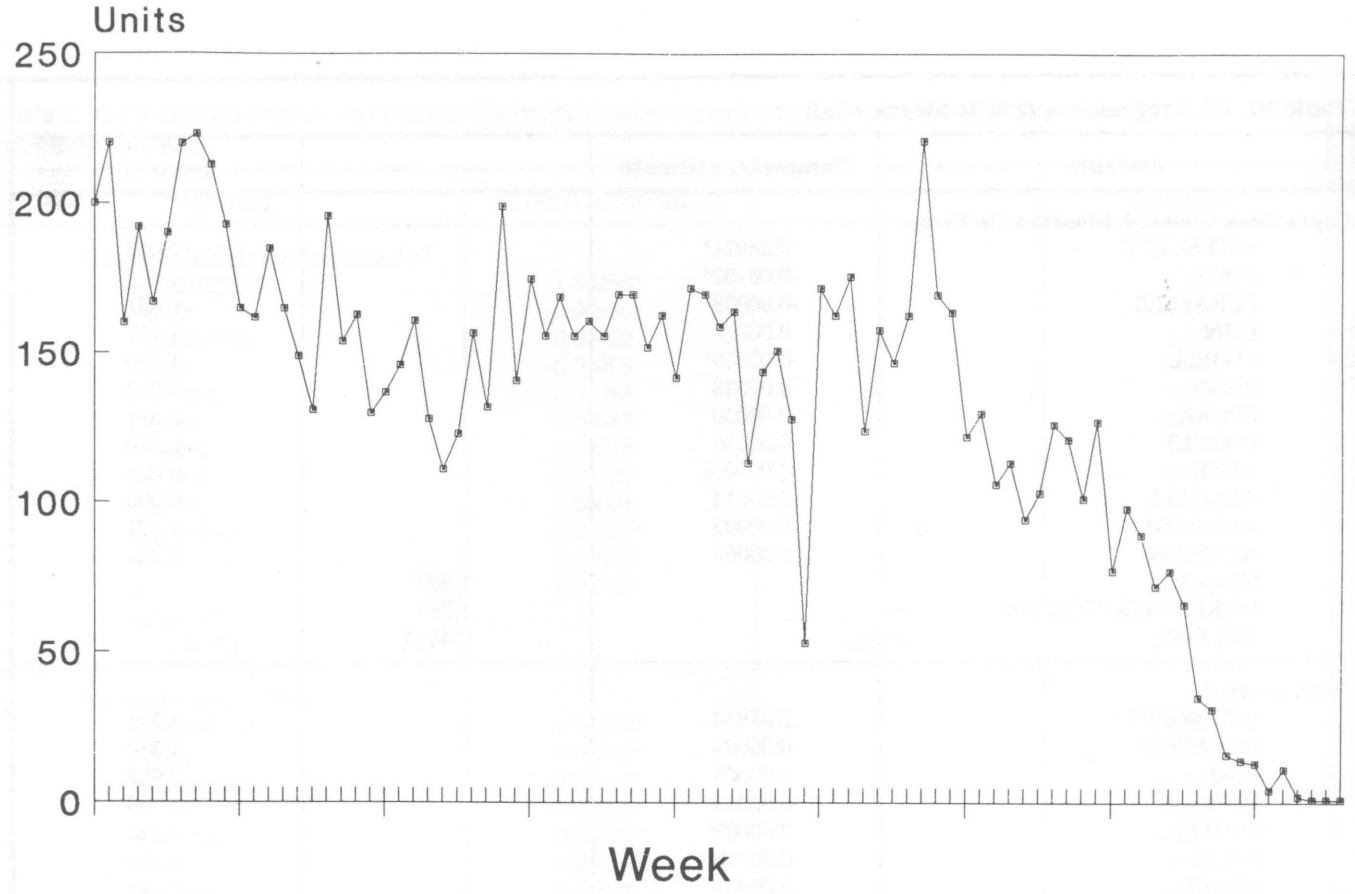

Figure 7. Purcahses of Mrs. Paul's Catfish Strips (UPC 1116211186).

goodness-of-fit, the econometric models were therefore highly satisfactory, especially with the relatively large amount of variation to be explained on a week-to-week basis.

The 0.05 level of significance was chosen for the statistical tests. According to Durbin-Watson (DW) tests, serial correlation problems were evident for fresh catfish, fresh ocean catfish fillets, and Hormel Catfish Bobber Snacks. To circumvent these serial correlation problems, a generalized least squares procedure (Cochrane-Orcutt) was used. For the other products, no serial correlation problems were apparent. The DW test statistics for the remaining products ranged from 1.331 to 2.309. On the basis of condition indices and variance decomposition proportions (Belsley et al., 1980), no degrading collinearity problems were evident.

Own-Price Effects

Consistent with prior expectations, all own-price elasticities were negative, and except for fresh ocean catfish fillets, fresh crawfish, and fresh cooked crawfish, the respective coefficients were statistically significant. The own-price elasticities were in the elastic range for all catfish products except for the aggregate convenience catfish. Except for fresh cooked crawfish, the own-price elasticities for crawfish were in the inelastic range. As exhibited in Table 12, the own-price elasticities for the individual convenience catfish products ranged from -2.723 to -13.652, and for fresh catfish, the range was from -1.295 to -6.046. The price elasticities for fresh catfish were within the range of previous work by Raulerson and Trotter (1973). The elastic demands at the retail level for catfish were also consistent with elastic demands documented by Kinnucan et al. (1988) at the processor level. The own-price elasticity for fresh crawfish was -0.835, and the own-price elasticity for Cajun Cook Crawfish Etouffe with Rice was -0.812. The demand for fresh cooked crawfish was elastic. The magnitude of this price elasticity was -2.682. In sum, considerable sample evidence exists to indicate that own-price exerts a notable influence on purchases, holding all other factors constant.

Cross-Price Effects

For fresh catfish products, only 6 of 24 cross-price elasticities were statistically different from zero. Cross-price elasticities may be either positive (indicative of gross substitutability) or negative (indicative of gross

Table 11. List and description of variable names.

Variable name	Description
PCATFRES	Weighted average price of fresh catfish
PCATCONV	Weighted average price of convenience (processed) catfish (prepared entrees)
PBEEF	Weighted average price of fresh beef
PPORK	Weighted average price of fresh pork
PPOULT	Weighted average price of fresh poultry
PFIN	Weighted average price of fresh finfish
PSHELL	Weighted average price of fresh shellfish
ADFIN	Advertisement space for finfish
ADSHELL	Advertisement space for shellfish
ADVAOM	Advertisement space for beef, pork, poultry, lamb, and veal
ADCAT	Advertisement space for catfish
ADCRAW	Advertisement space for crawfish
SEASON	Monthly dummy variables (M1, ..., M11) to capture seasonality; (M1=1 if January, 0 otherwise; ..., M11=1 if November, 0 otherwise). Reference month, December.
P206140	Price of fresh ocean catfish fillets
P206081	Price of fresh farm-raised catfish fillets
P206074	Price of fresh whole catfish
P3764	Price of Hormel Catfish Bobber Snacks
P3761	Price of Hormel Catfish Fillets
P183	Price of Cajun Cook Crawfish Etouffe with Rice
PCRAFRES	Weighted average price of fresh crawfish
P206080	Price of fresh cooked crawfish

Table 12. A summary of the econometric analyses for catfish and crawfish species.

UPC code	Own-price elasticity[a]	Own-advertisement elasticity[a]	ADJRSQ[b]	Seasonality[c]
Catfish				
3760015151	-2.723	NS	0.5789	3.763*
3760042214	-13.652	NS	0.9239	5.479*
Convenience catfish	-0.284	-0.073	0.6971	6.219*
20607400000	-6.046	NS	0.6214	0.681
20608100000	-3.321	0.058	0.7707	1.989*
20614000000	NS (-1.295)	NS	0.5693	6.473*
Fresh catfish	-2.157	0.109	0.6762	1.999*
Crawfish				
1830012021	-0.812	NS	0.4413	1.502
20608000000	NS (-2.682)	NS	0.4839	2.413*
Fresh crawfish	NS (-0.835)	NS	0.5465	2.241*

a At sample means.
[b] Adjusted $\overline{R}^2$.
[c] F-statistic.
* Statistically significant at the 0.05 level.
NS refers to the regression coefficient as not statistically different from zero.

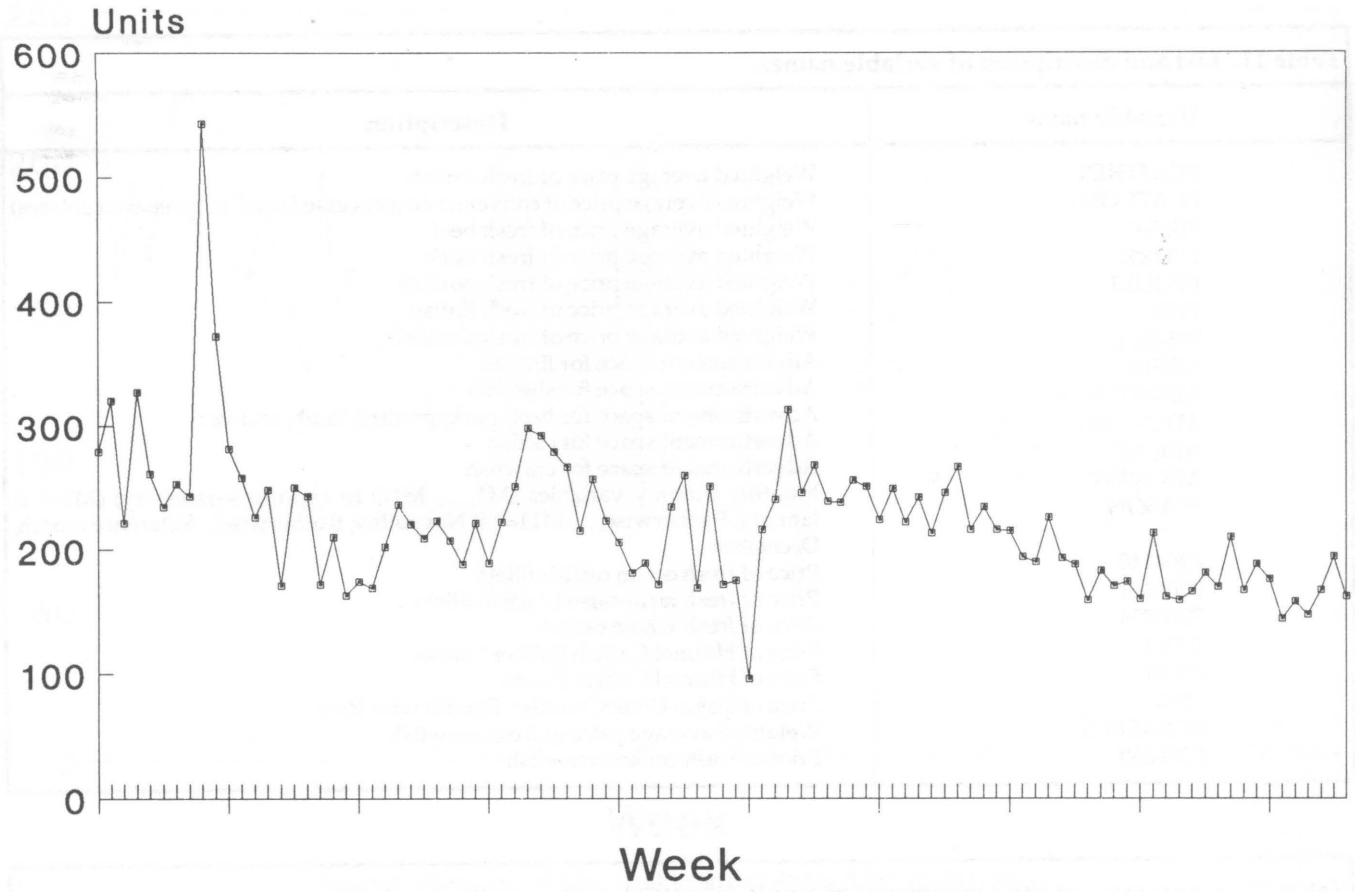

Figure 8. Purchases of Hormel Catfish Fillets (UPC 3760015151).

complementarity). The price of finfish items positively influenced purchases of fresh ocean catfish fillets as well as the aggregate category of fresh catfish. The cross-price elasticities at the sample means were 5.405 and 0.602. Prepared catfish entrees and fresh ocean catfish fillets were gross complements (cross-price elasticity of -9.432 at the sample means). Similarly pork and fresh ocean catfish fillets were gross complements (cross-price elasticity of -7.101 at the sample mean). Shellfish and fresh whole catfish were also gross complements (cross-price elasticity of -1.126 at the sample means), and pork and fresh whole catfish were gross complements (cross-price elasticity of -1.160 at the sample means). However, for fresh farm-raised catfish fillets, cross-price effects were not statistically different from zero.

For convenience catfish products (prepared entrees), 5 of 18 cross-price elasticities were statistically different from zero. The price of fresh catfish, beef, and finfish negatively affected purchases of the aggregate of all convenience catfish products. At the sample means, the cross-price elasticity for fresh catfish and convenience catfish was -1.003; for beef and convenience catfish, the cross-price elasticity was -0.661; for finfish and convenience catfish, the cross-price elasticity was -1.247. On the other hand, the price of shellfish positively affected purchases of the aggregate of all convenience catfish products. At the sample means, the cross-price elasticity was 1.140. For the two individual prepared entrees, only one statistically significant cross-price effect was evident. Shellfish and Hormel Catfish Fillets were gross substitutes (cross-price elasticity of 0.276 at the sample means). Cross-price effects are not statistically significant for Hormel Catfish Bobber Snacks.

For the prepared entree Cajun Cook Crawfish Etouffe with Rice, shellfish was the only statistically significant cross-price variable. The cross-price elasticity at the sample means was -0.308, indicative of gross complements. The price of shellfish positively affected purchases of fresh crawfish (cross-price elasticity of 1.316 at the sample means). The prices of beef and of finfish negatively influenced purchases of fresh crawfish. The cross-price elasticities of beef and finfish were -1.914 and -2.320, respectively, at the sample means. Prices of competing products were, however, not im-

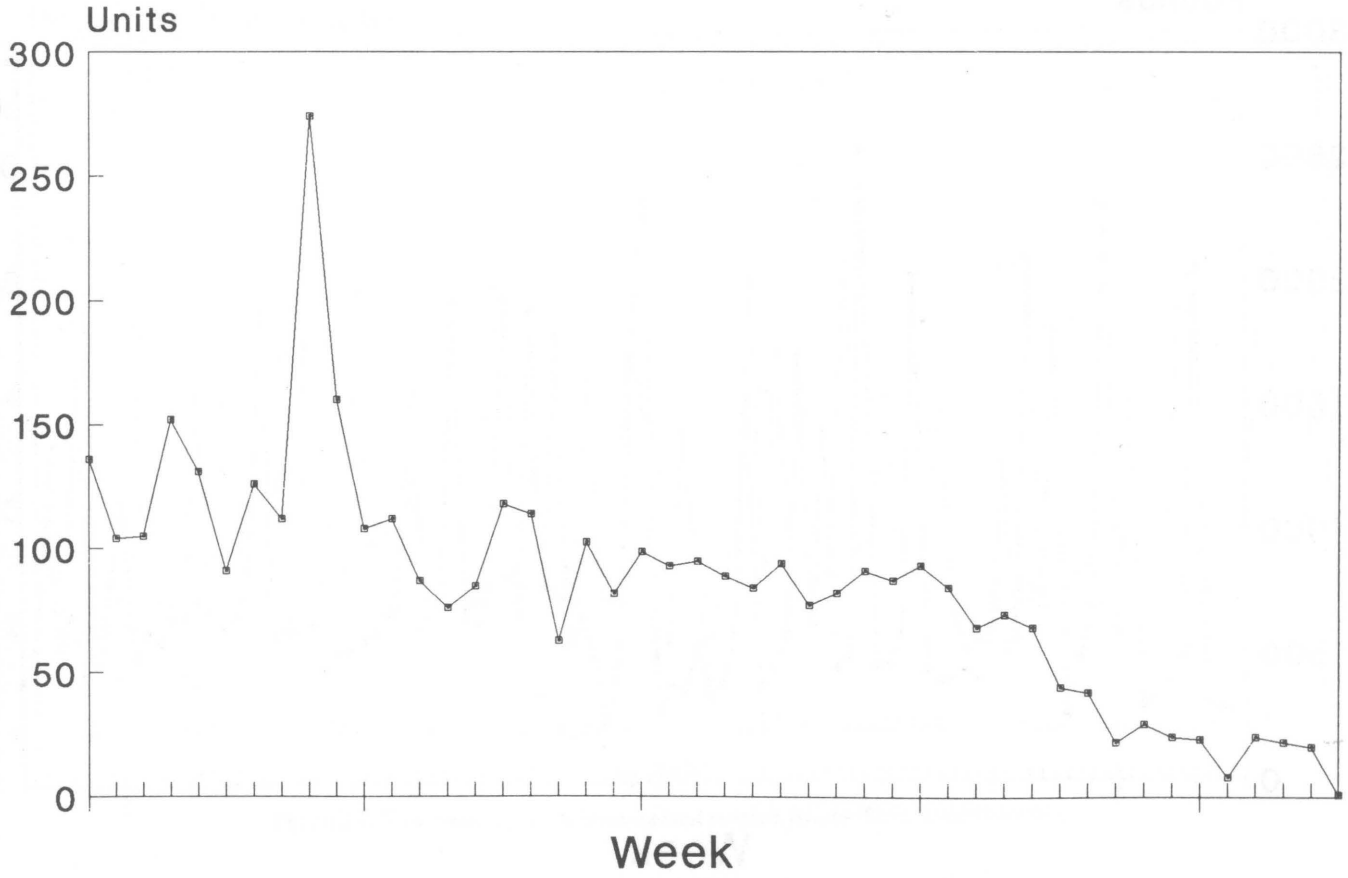

Figure 9. Purchases of Hormel Catfish Bobber Snacks (UPC 3760042214).

portant influences on purchases of fresh cooked crawfish.

Advertisement Effects

Consistent with prior expectations, own-advertisement elasticities were significantly different from zero and were positive for fresh farm-raised catfish fillets and the aggregate of all fresh catfish products. As exhibited in Table 12, the respective own-advertisement elasticities for these products were 0.058 and 0.109 at the sample means; consequently the own-advertisement elasticities were much smaller in magnitude than the corresponding own-price elasticities. In contrast with expectations, own-advertisement effects were negative and significantly different from zero for the aggregate category of prepared catfish entrees. Own-advertisement effects were not significant for crawfish products. Few cross-advertisement effects were significantly different from zero for either catfish or crawfish products. Advertisement exposure for finfish (shellfish) negatively influenced purchases of fresh crawfish (Hormel Catfish Bobber Snacks), whereas the aggregate advertisement of beef, pork, poultry, lamb, and veal positively influenced purchases of convenience catfish and negatively influenced purchases of fresh whole catfish.

Pairwise correlation coefficients between own-price and own-advertisement effects for catfish and crawfish products were, except for fresh farm-raised catfish fillets and the aggregate category of prepared catfish entrees, not statistically different from zero. In these cases, a significant albeit relatively small negative association (correlation coefficients of -0.2024 and -0.2400, respectively) existed between own-price and own-advertisement variables. For the remaining products, no statistical association was evident between product price and product exposure (advertisement space).

Seasonality

Seasonality was a major determinant of purchases of all catfish products except for fresh whole catfish. All other things held constant, purchases of the aggregate of fresh catfish products were significantly higher in January, March, April, July, August, and October. For fresh farm-raised catfish fillets, purchases were sig-

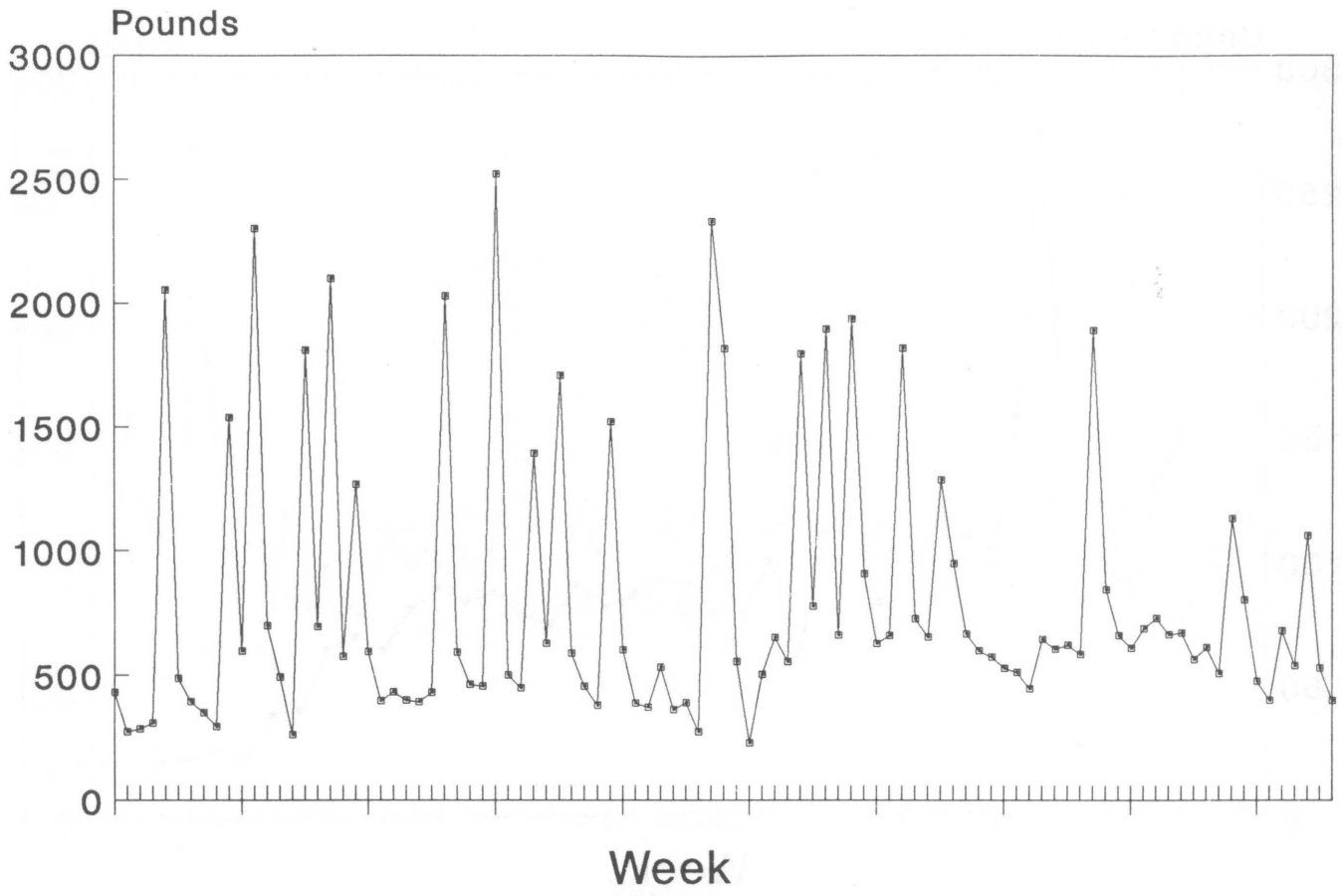

Figure 10. Purchases of fresh whole catfish (UPC 20607400000).

nificantly higher from January to May as well as from July to October relative to the other months. Fresh ocean catfish fillets purchases, however, were significantly lower in all months relative to December. For the aggregate of convenience catfish products as well as for Hormel Catfish Fillets, purchases were significantly higher from January to May and from September to November relative to other months. For Hormel Catfish Bobber Snacks, purchases were significantly higher in January and May and significantly lower in February, September, October, and November relative to other months.

Seasonality for crawfish was a key factor only in purchases of fresh cooked crawfish or fresh crawfish. Seasonality was not a statistically significant determinant of the purchase of Cajun Cook Crawfish Etouffe with Rice. For fresh cooked crawfish and for fresh crawfish, purchases were significantly higher from January to June relative to other months.

Summary, Conclusions, and Implications for Further Research

Although scanner data have been available for several years to marketers, such data represent a new form of information to the aquacultural sector. This study constitutes a pilot test of the use of scanner data to investigate the demand for catfish and crawfish products for a local market (retail food firm) in Houston. The time frame for this analysis was the period January 1987 to November 1988.

This study rests on analyses of seven individual catfish and crawfish products as well as commodity aggregates (fresh and convenience catfish and crawfish). Although work with scanner data was exacting, requiring much computational effort, useful descriptive statistics and graphs of prices and purchases can be generated. With additional effort, information on customer counts and advertising can be obtained for this firm. Extreme caution is in order, however, in the organization of scanner data for analysis.

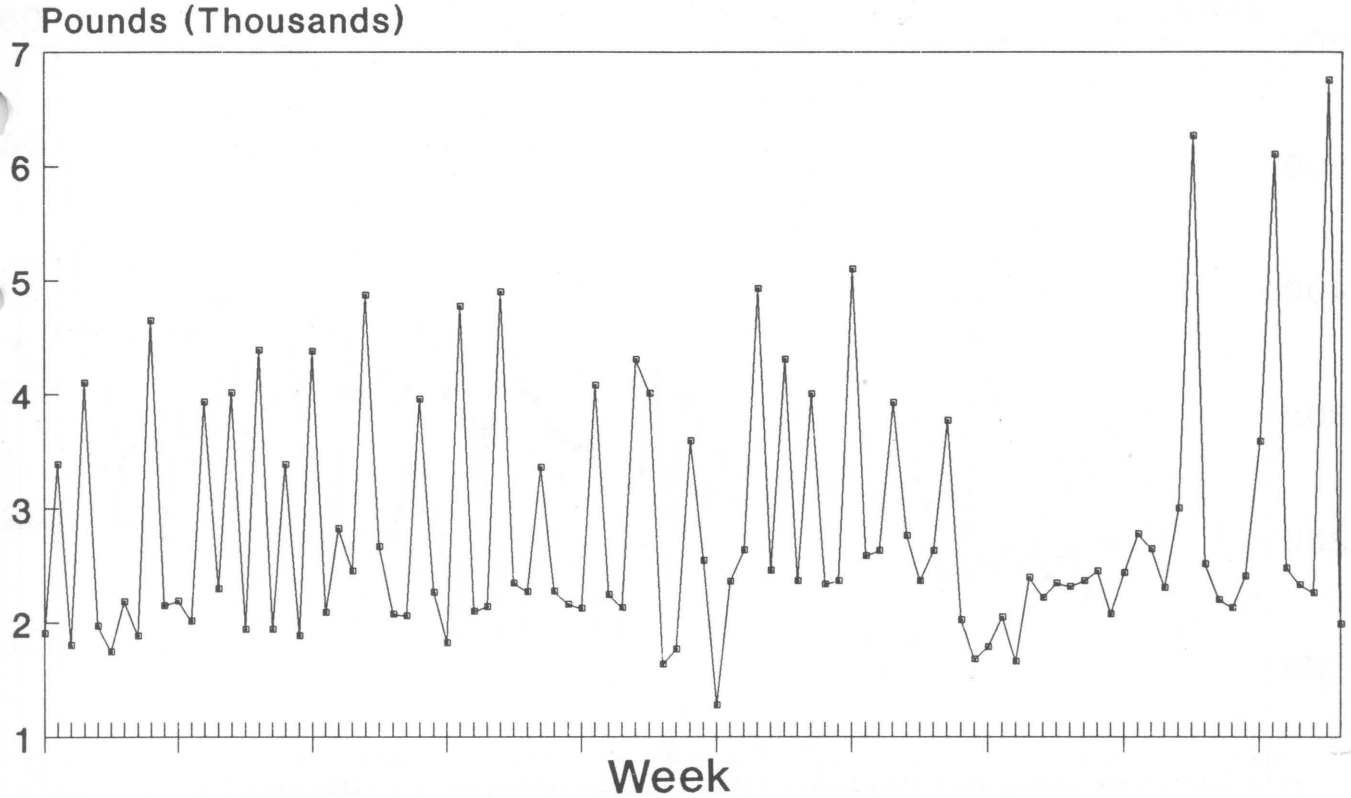

Figure 11. Purchases of fresh farm-raised catfish fillets (UPC 29608100000).

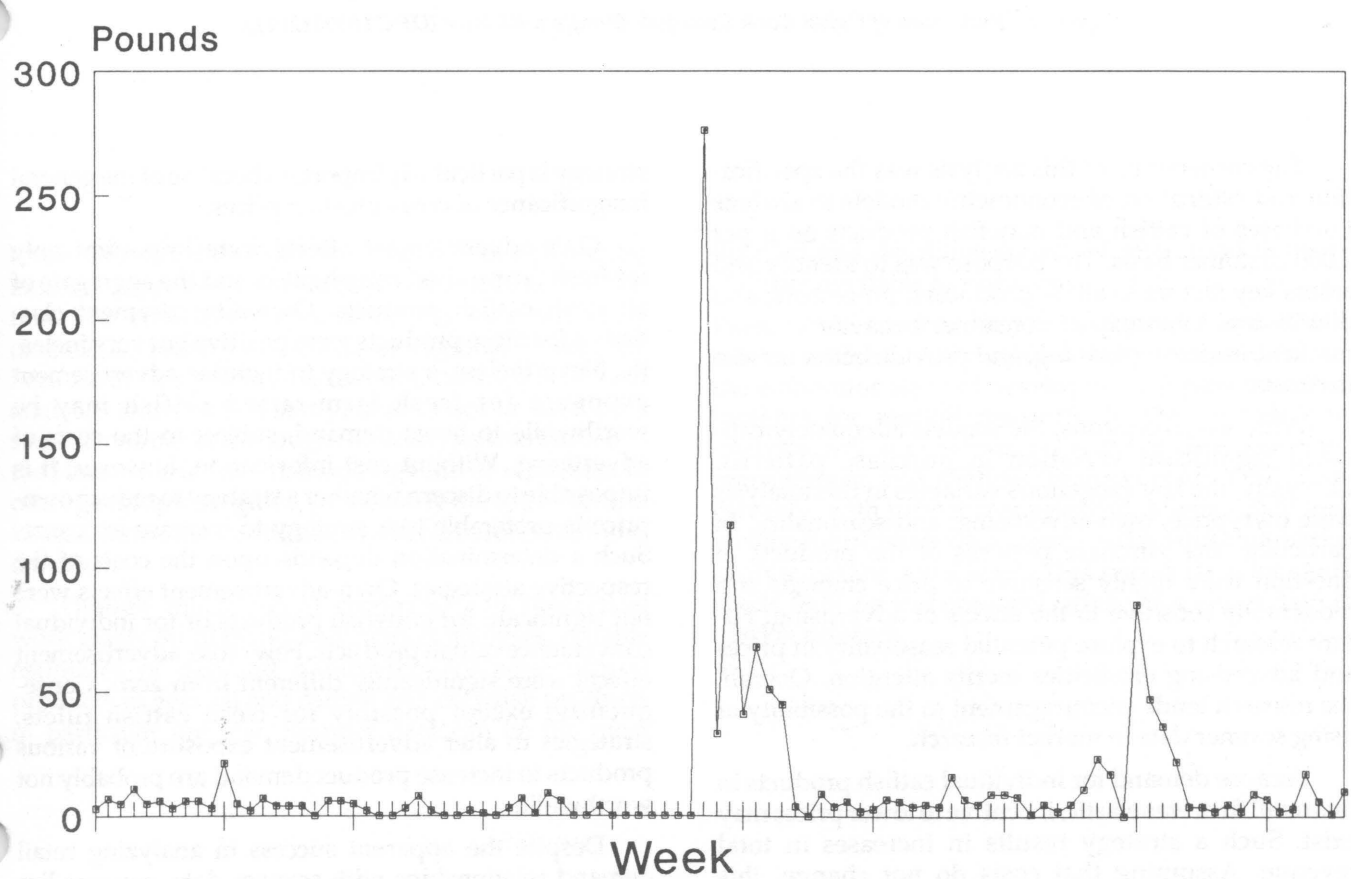

Figure 12. Purchases of fresh ocean catfish fillets (UPC 20614000000).

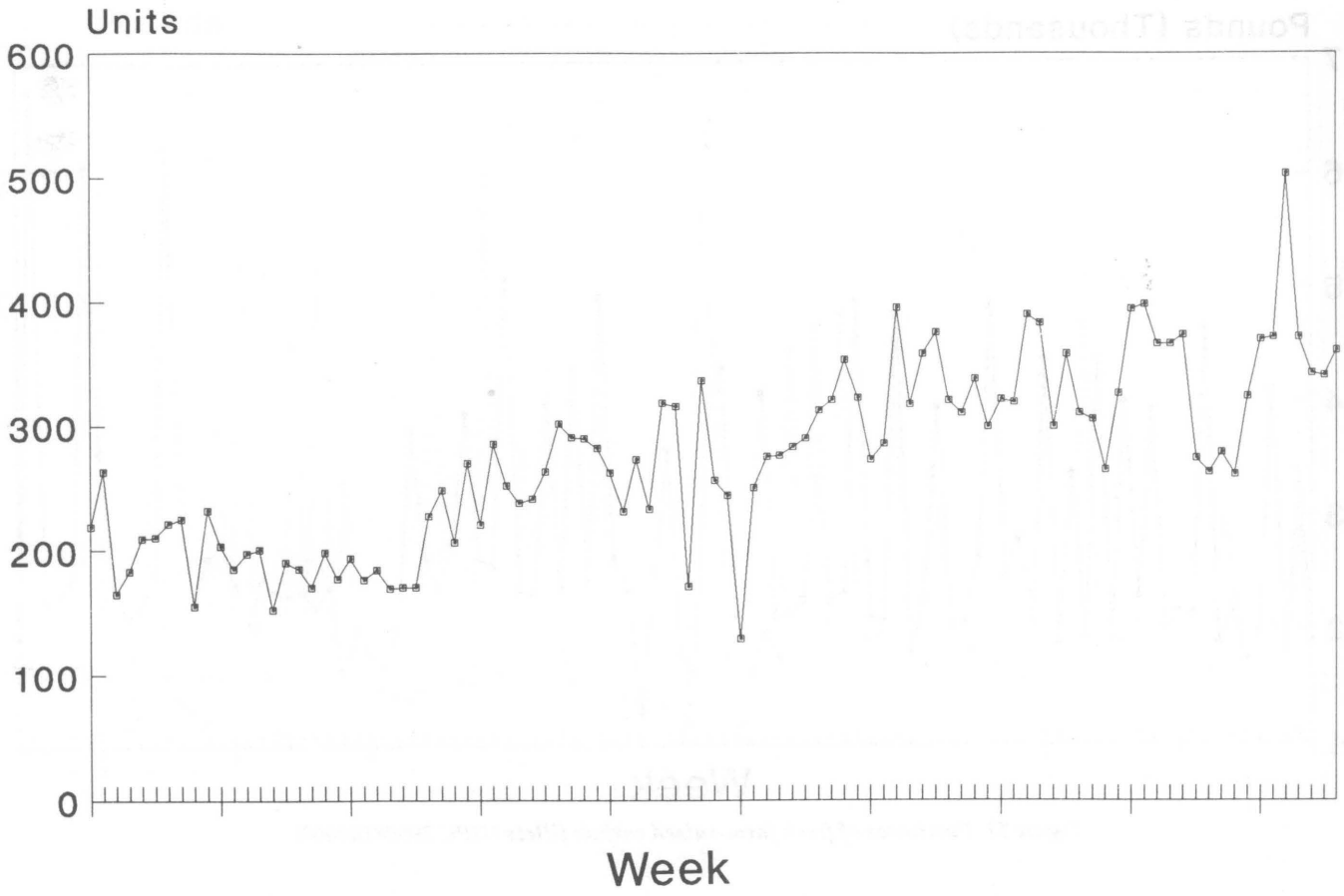

Figure 13. Purchases of Cajun Cook Crawfish Etouffe with Rice (UPC 1830012021).

The cornerstone of this analysis was the specification and estimation of econometric models to analyze purchases of catfish and crawfish products on a per 1,000 customer basis. The purpose was to identify and assess key factors to allow producers, processors, and distributors to anticipate consumer behavior in retail markets, improve planning, and provide better service to consumers.

With few exceptions, the models adequately captured significant variation in purchase patterns. Generally, the key exogenous variables in this analysis were own-price, own-advertising, and seasonality. In particular, the purchase patterns of the products in question were highly sensitive to price changes and moderately sensitive to the effects of advertising. Future research to explore potential seasonality in prices and advertising elasticities merits attention. Overall, the research lends encouragement to the possibility of using scanner data in market research.

Because demand for individual catfish products in this retail firm was elastic, incentive to lower prices may exist. Such a strategy results in increases in total revenue. Assuming that costs do not change, this strategy is particularly important because of the general insignificance of cross-product prices.

Own-advertisement effects were important only for fresh farm-raised catfish fillets and the aggregate of all fresh catfish products. Own-advertisement elasticities for these products were positive but very inelastic. Nevertheless, a strategy to increase advertisement exposure for fresh farm-raised catfish may be worthwhile to boost demand, subject to the costs of advertising. Without cost information, however, it is impossible to discern whether a strategy to reduce own-price is preferable to a strategy to increase exposure. Such a determination depends upon the costs of the respective strategies. Own-advertisement effects were not significant for crawfish products or for individual convenience catfish products. Few cross-advertisement effects were significantly different from zero. Consequently, except possibly for fresh catfish fillets, strategies to alter advertisement exposure of various products to increase product demand are probably not worthwhile.

Despite the apparent success in analyzing retail demand relationships with scanner data, concern lies with generalizing the results to regional or national

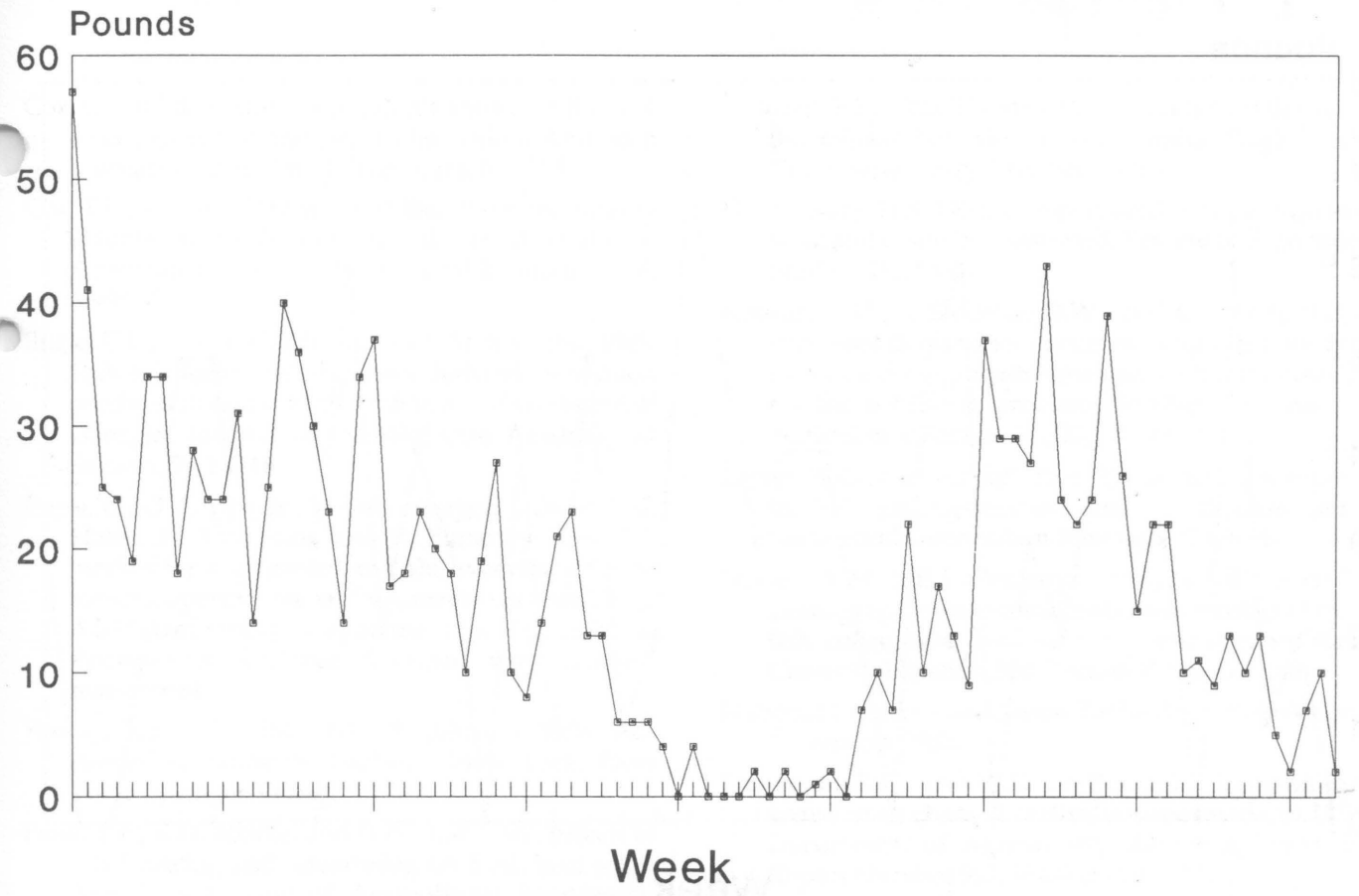

Figure 14. Purchases of fresh cooked crawfish (UPC 20608000000).

levels. Scanner data from supermarkets in a particular location represent a "controlled" experimental situation. The community-specific results may not allow defensible, broad nationwide or regional inferences. Because of this potential limitation, the results of local analyses (such as this study) should not be used on a stand-alone basis. Although this analysis was limited to the Houston area, the methodology can be replicated in other geographic regions, particularly the south-central United States, the traditional market area for catfish and crawfish.

Though much recent empirical and theoretical work exists on demand and market analyses, reliable estimates of demand parameters for aquacultural products in general and catfish and crawfish products in particular are few. Scanner data can be the most detailed and definitive source of retail food industry statistics available to researchers.

User of scanner data can expand demand and market analyses. Although the use of scanner data is in the embryonic stage of development, it promises fresh insights for market research. In the next decade, analysts will concentrate on scanner data assembly, management, and analysis (Branson et al., 1987). Conceivably, with proper management, scanner data may well be the ultimate data source of demand and market analyses at the retail level. This particular pilot study sheds light on the potential utility of scanner data in market research.

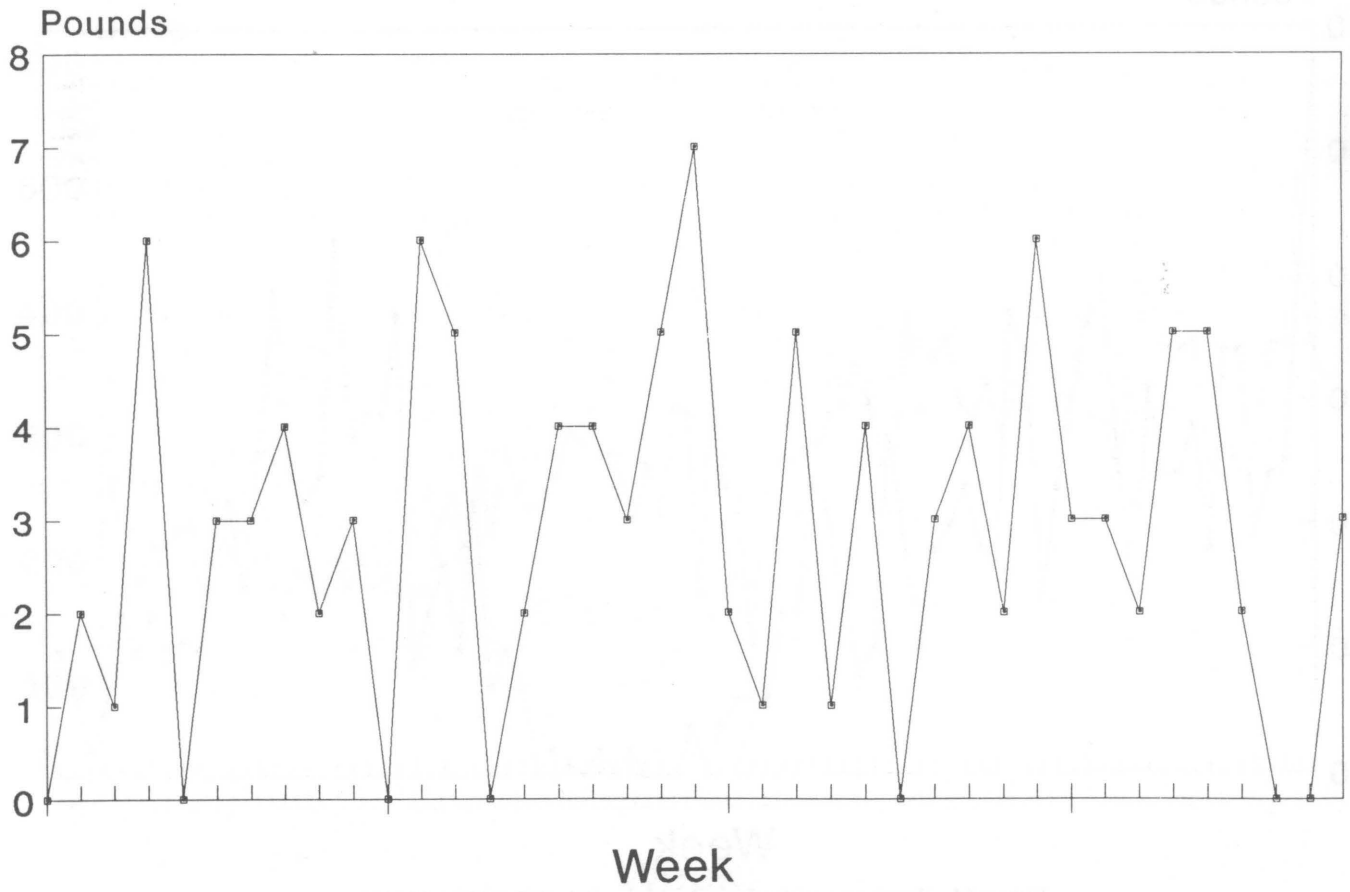

Figure 15. Purchases of frozen cooked crawfish meat(UPC 206013600000).

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Literature Cited

Belsley, D.A., E. Kuh, and R.E. Welsch. 1980. Regression diagnostics: identifying influential data and sources of collinearity. New York, New York: John Wiley and Sons.

Branson, R.E., et al. 1987. Data sources for demand analysis, *in* R. Rauniker and C.L. Huang eds. Food demand analysis: problem, issues and empirical evidence. Iowa State Press.

Capps, Jr., O. 1989. Utilizing scanner data to estimate retail demand functions for meat products. American Journal of Agricultural Economics, 71, 3:750-60.

Carmen, H.F., and E.F. Figueroa. 1986. An analysis of factors associated with weekly food store sales variation. Agribusiness, 2:375-90.

Cheng, H.T., and O. Capps, Jr. 1988. Demand analysis of fresh frozen finfish and shellfish in the United States. American Journal of Agricultural Economics, 70, 3:533-542.

Cox, C., and R. Foster. 1985. What's ahead for the U.S. food processing industry? Discussion. American Journal of Agricultural Economics, 67:1155-7.

Cox, T.L., and M. Wohlgenant. 1986. Prices and quality effects in cross-sectional demand analysis. American Journal of Agricultural Economics, 68, 5:908-19.

Engle, C.R., Upton Hatch, and Scott M. Swinton. 1988. Factors affecting retail grocery demand for seafood products in east-central Alabama and west-central Georgia. Journal of the Alabama Academy of Science, 59, 1:1-16.

Engle, C., O. Capps, Jr., L. Dellenbarger, J. Dillard, U. Hatch, H. Kinnucan, and R. Pomeroy. The U.S. market for farm-raised catfish: overview of consumer, supermarket, and restaurant surveys. Texas A&M University, Department of Agricultural Economics, College Station, unpublished manuscript.

Fomby, T.B., R.C. Hill, and S.R. Johnson. 1984. Advanced econometric methods. New York, New York: Springer-Verlag.

Funk, T.F., K.D. Meilke, and H.B. Huff. 1977. Effects of retail pricing and advertising on fresh beef sales. American Journal of Agricultural Economics, 59:533-37.

Hatch, L.U. 1988. National survey of U.S. fish consumption. Presented to the Aquaculture International Congress and Exposition, Vancouver, British Columbia, Canada.

Holdren, B.R. 1960. The structure of a retail market and the market behavior of retail units. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Houthakker, H.S. 1952. Compensated change in quantities and qualities consumed. Review of Economic Studies, 19:155-64.

Kinnucan, H., S. Sindelar, D.W., and U. Hatch. 1988. Processor demand and price-markup functions for catfish: a disaggregated analysis with implications for the off-flavor problem. Southern Journal of Agricultural Economics, 20,2:81-91.

Lesser, W.G., and J. Smith. 1986. The accuracy of supermarket scanning data: an initial investigation. Journal of Food Distribution Research, 17:69-74.

McGee, W.M., L.E. Dellenbarger, and J.G. Dillard. 1989. Demographic and attitudinal characteristics of catfish consumers. Southern Regional Aquaculture Center Publication 508, Technical Bulletin 168.

National Grocers Association Technology Newsletter, November 1985.

Raulerson, R.C., and W.K. Trotter. 1973. Demand for farm-raised channel catfish in supermarkets. U.S. Department of Agriculture, Marketing Research Report Number 993, Washington, D.C.

Tomek, W.G. 1985. Limits on price analysis. American Journal of Agricultural Economics, 67:905-15.

Appendix

Graphs of Prices of Catfish and Crawfish Products

Figure A.1. Price of fresh catfish.

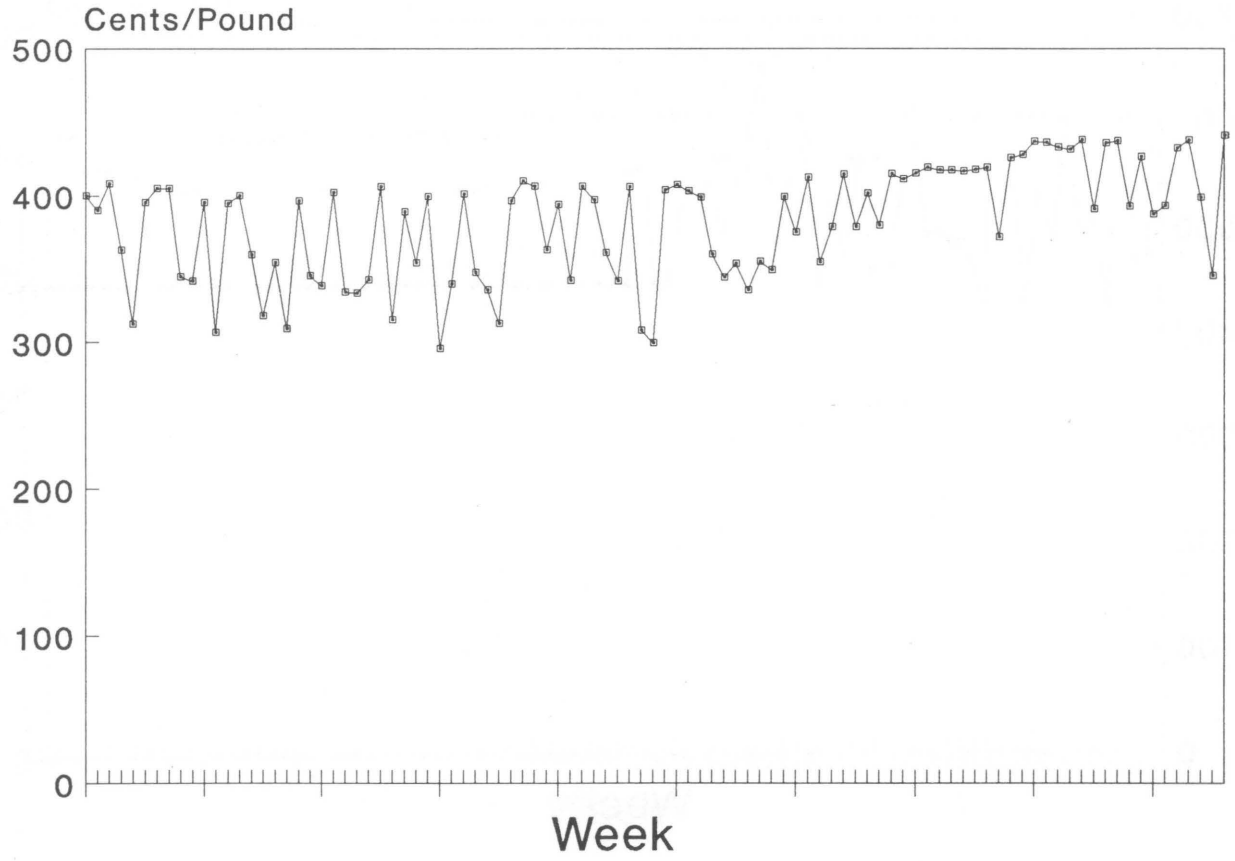


Figure A.2. Price of convenience (processed) catfish.

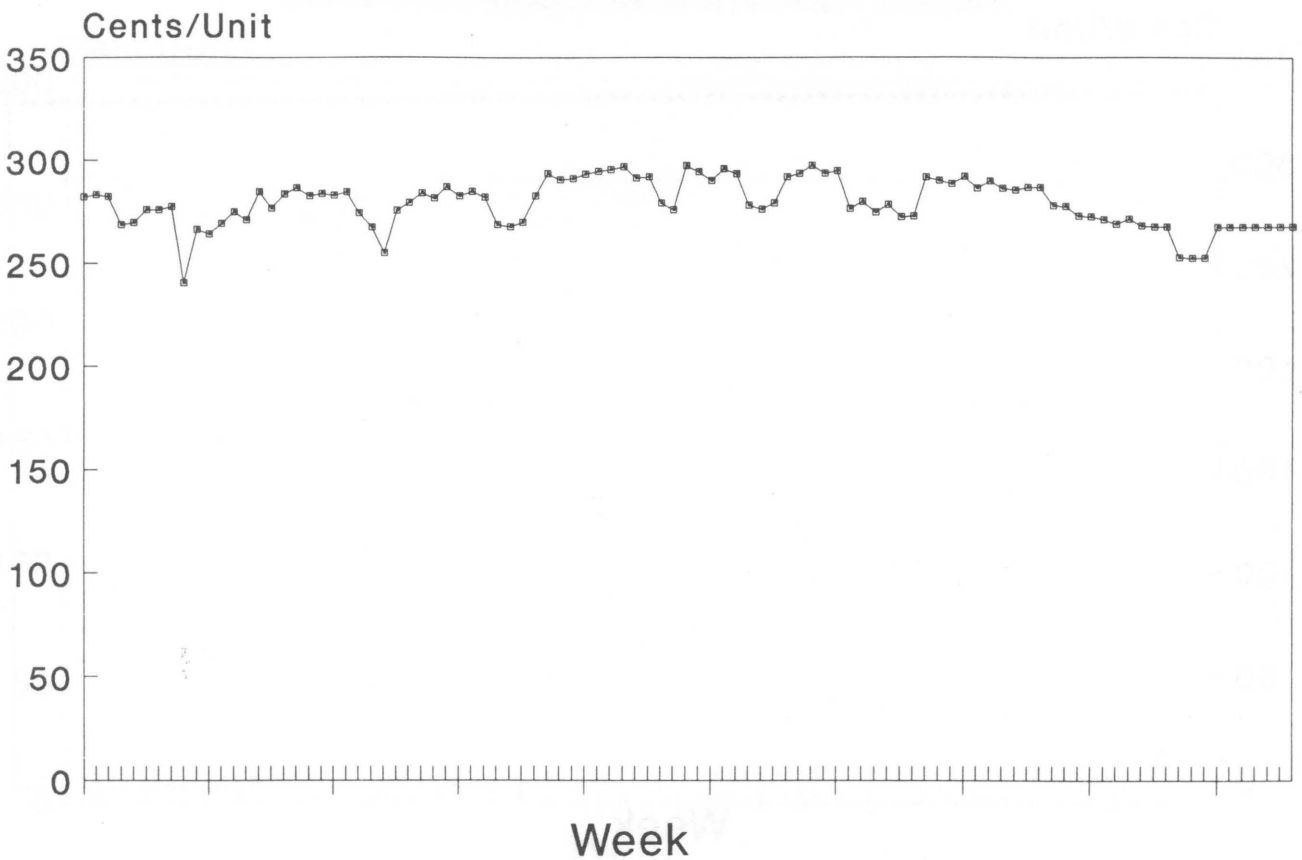


Figure A.3. Price of fresh crawfish.

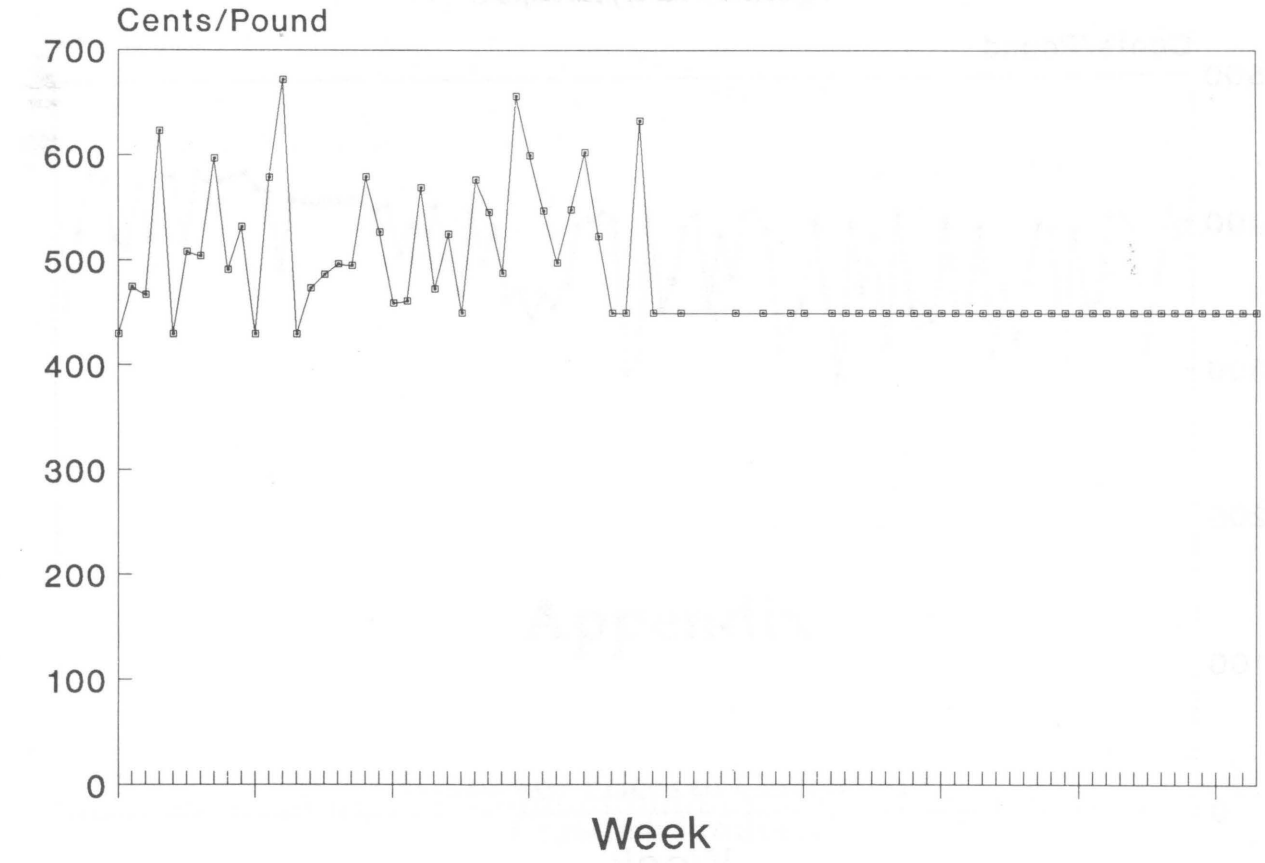


Figure A.4. Price of Mrs. Paul's Catfish Strips (UPC 1116211186).

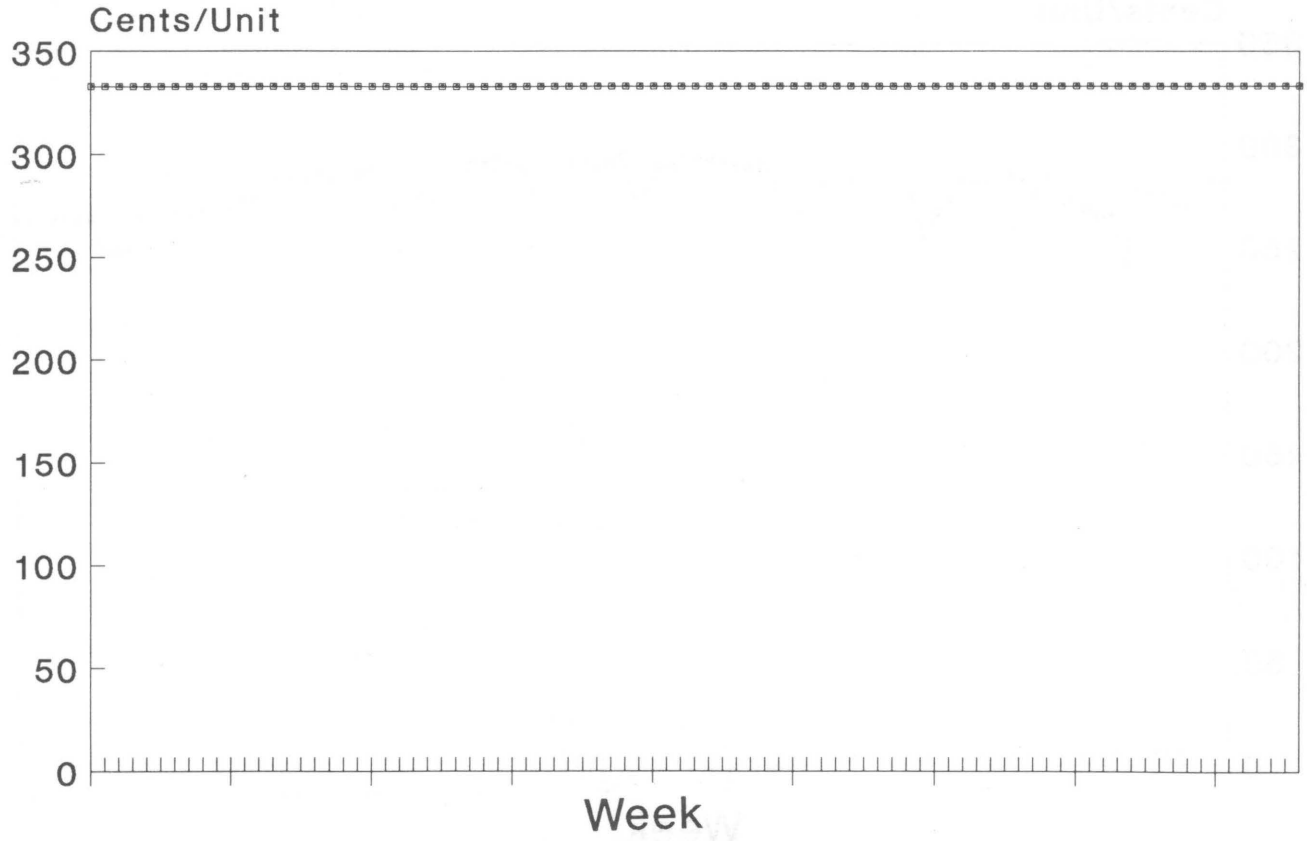


Figure A.5. Price of Hormel Catfish Fillets (UPC 3760015151).

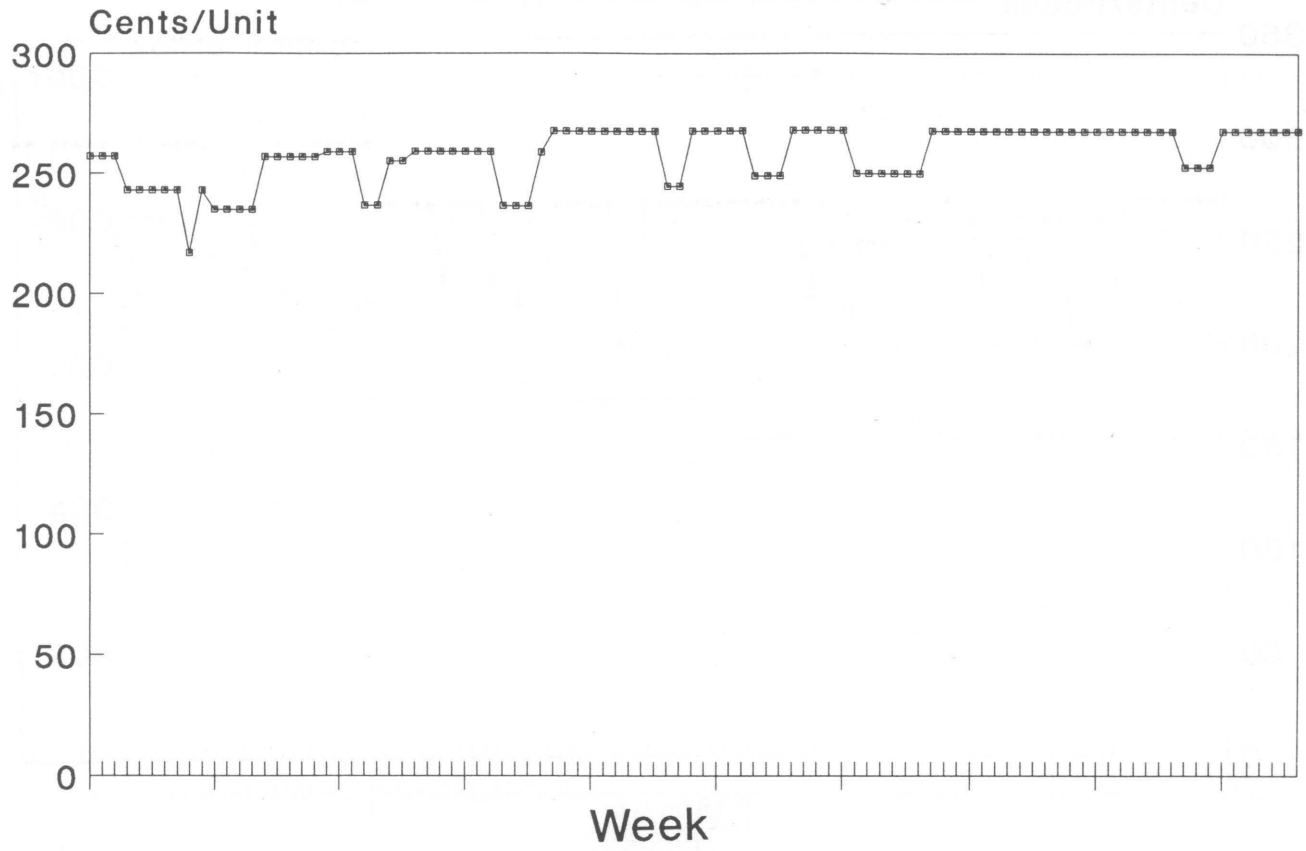


Figure A.6. Price of Hormel Catfish Bobber Snacks (UPC 3760042214).

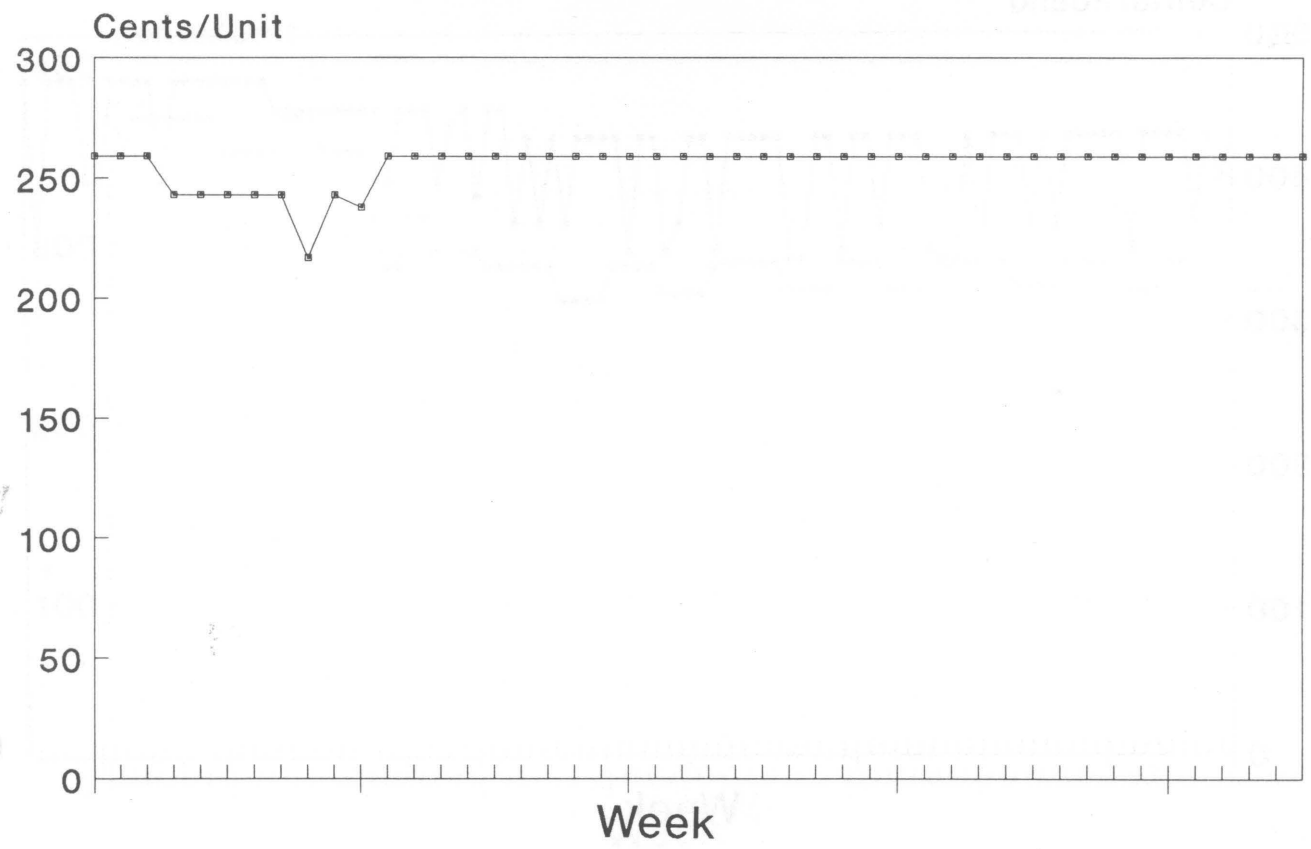


Figure A.7. Price of fresh whole catfish (UPC 20607400000).

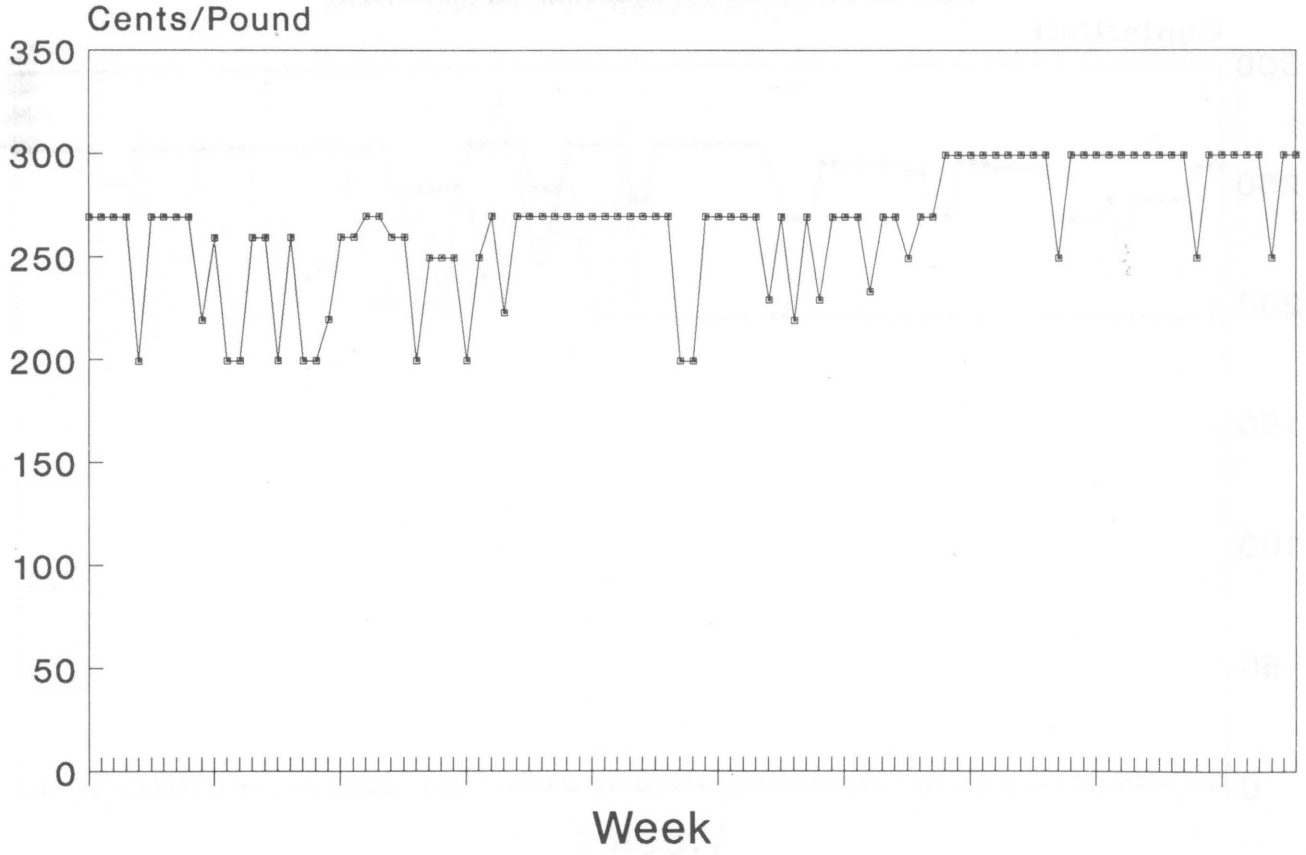


Figure A.8. Price of fresh farm-raised catfish fillets (UPC 20608100000).

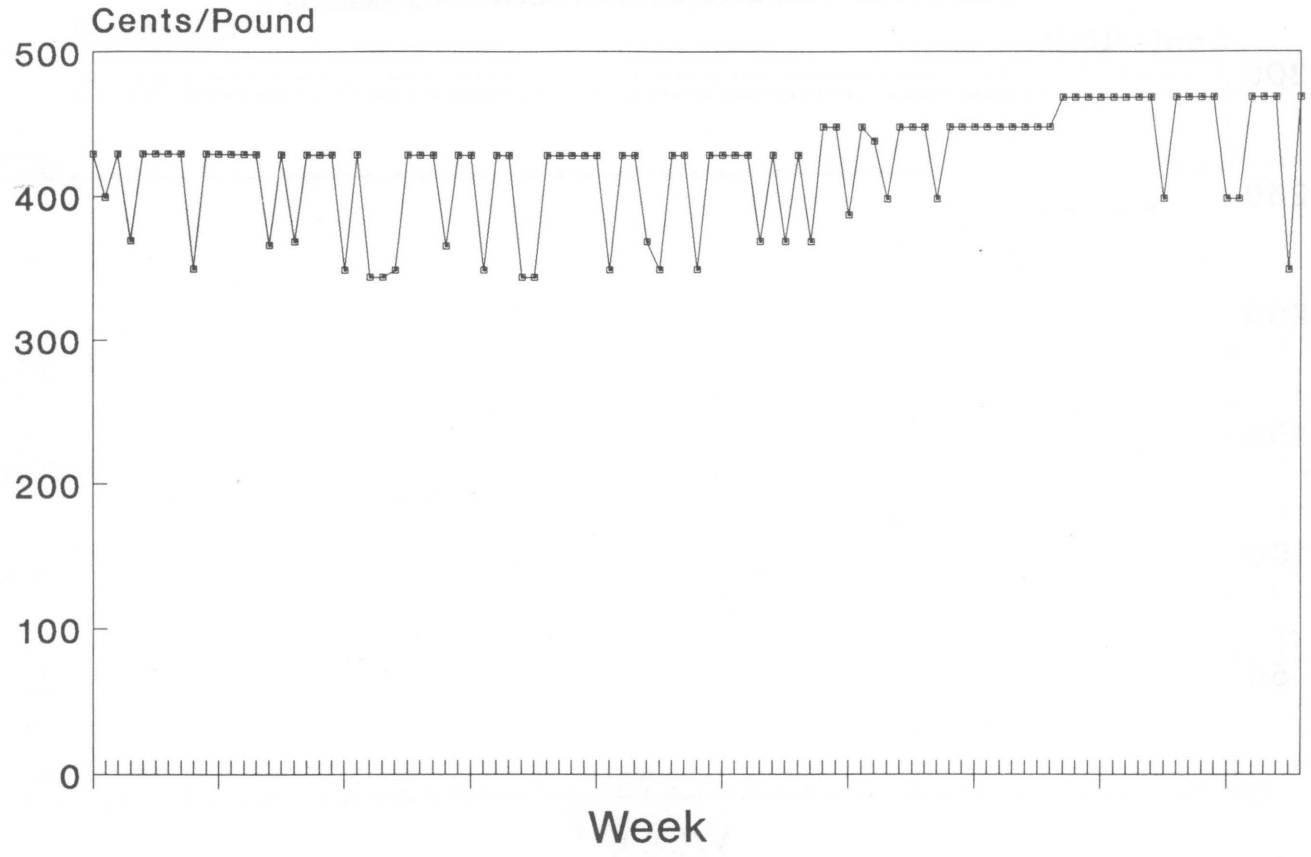


Figure A.9. Price of fresh ocean catfish fillets (UPC 20614000000).

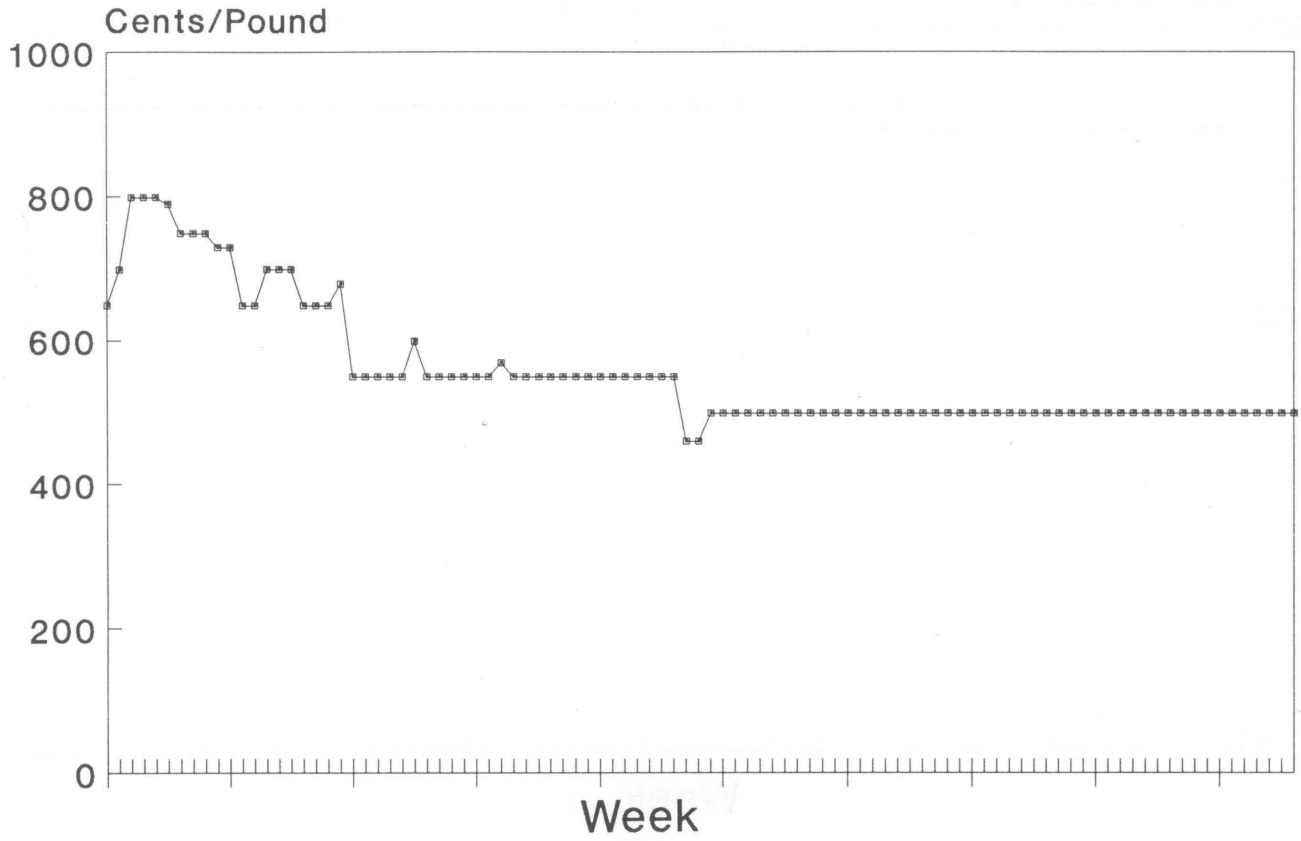


Figure A.10. Price of Cajun Cook Crawfish Etouffe with Rice (UPC 1830012021).

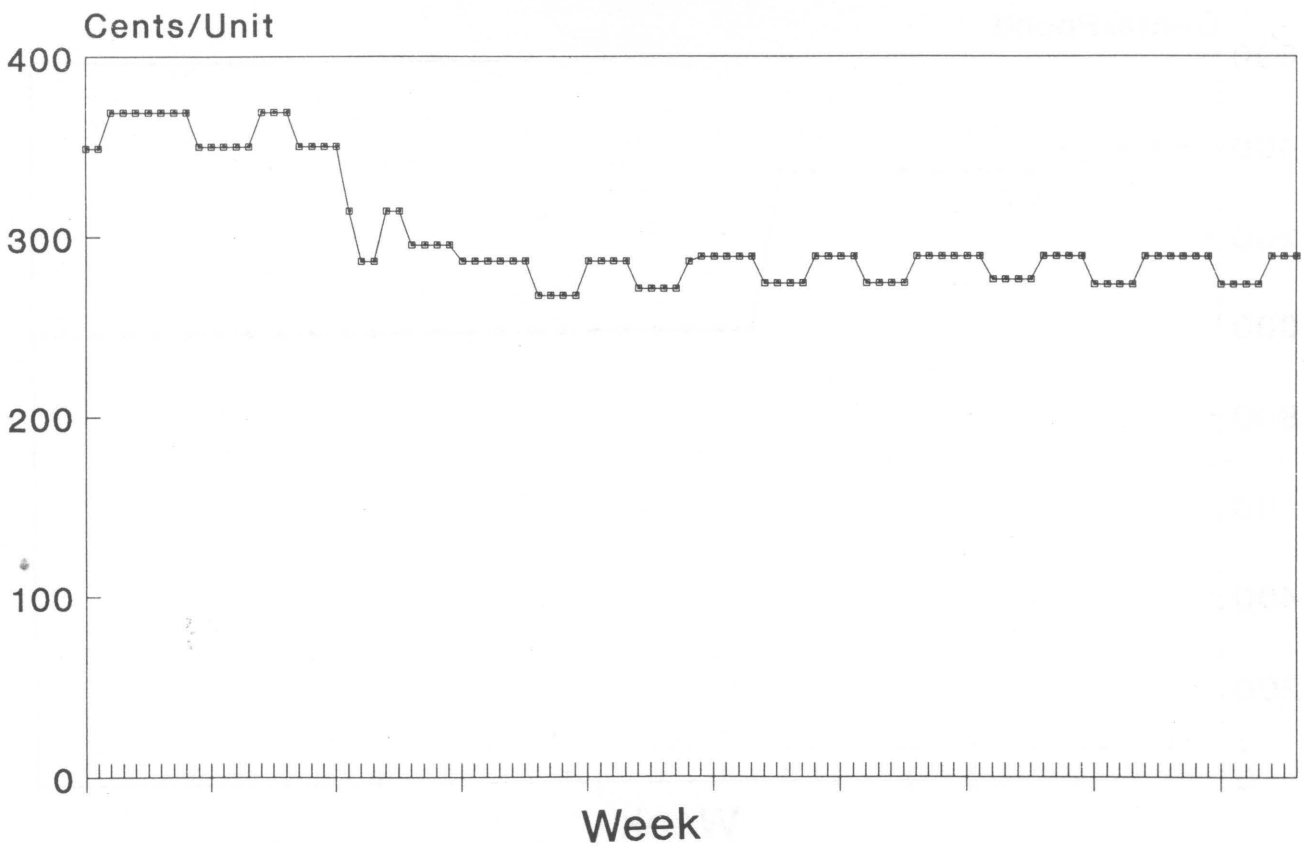


Figure A.11. Price of fresh cooked crawfish (UPC 20608000000).

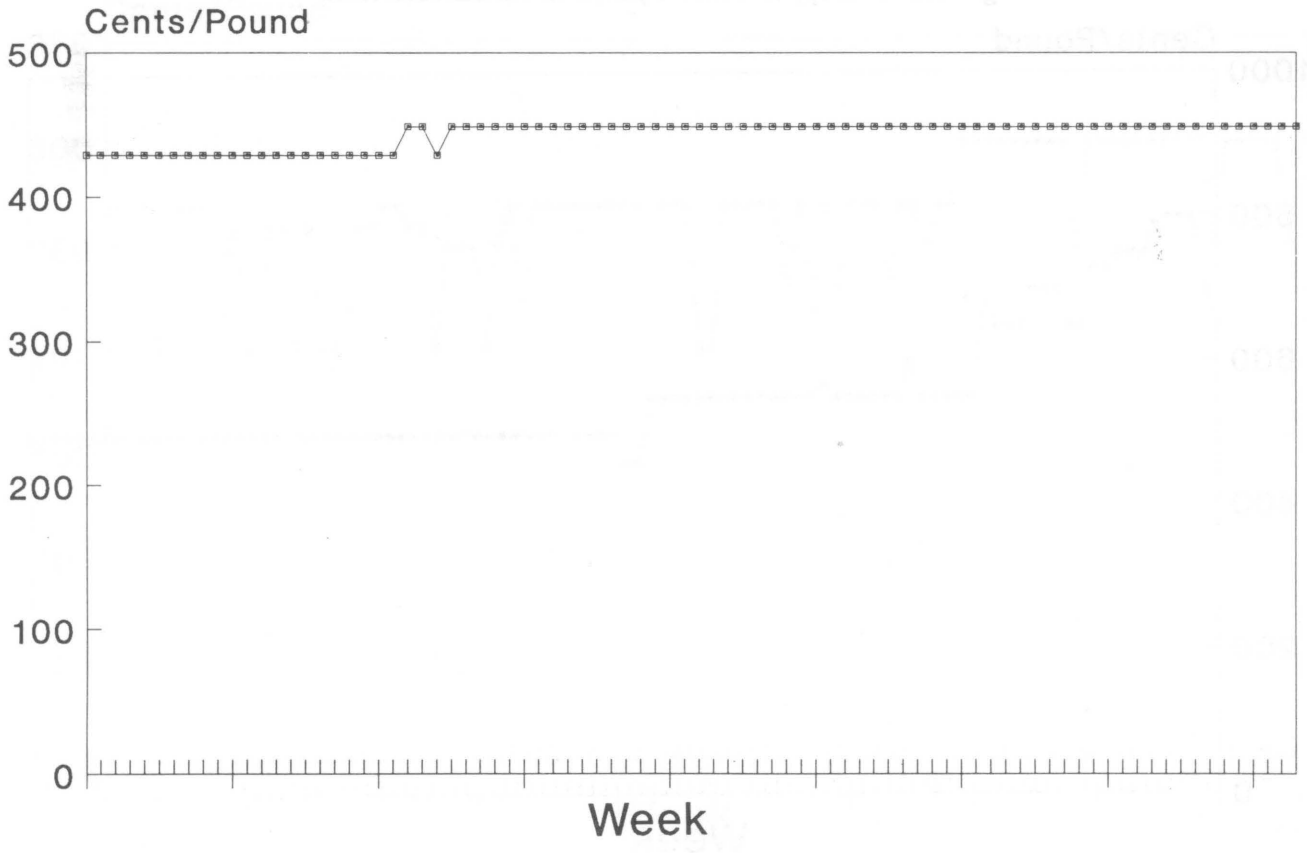
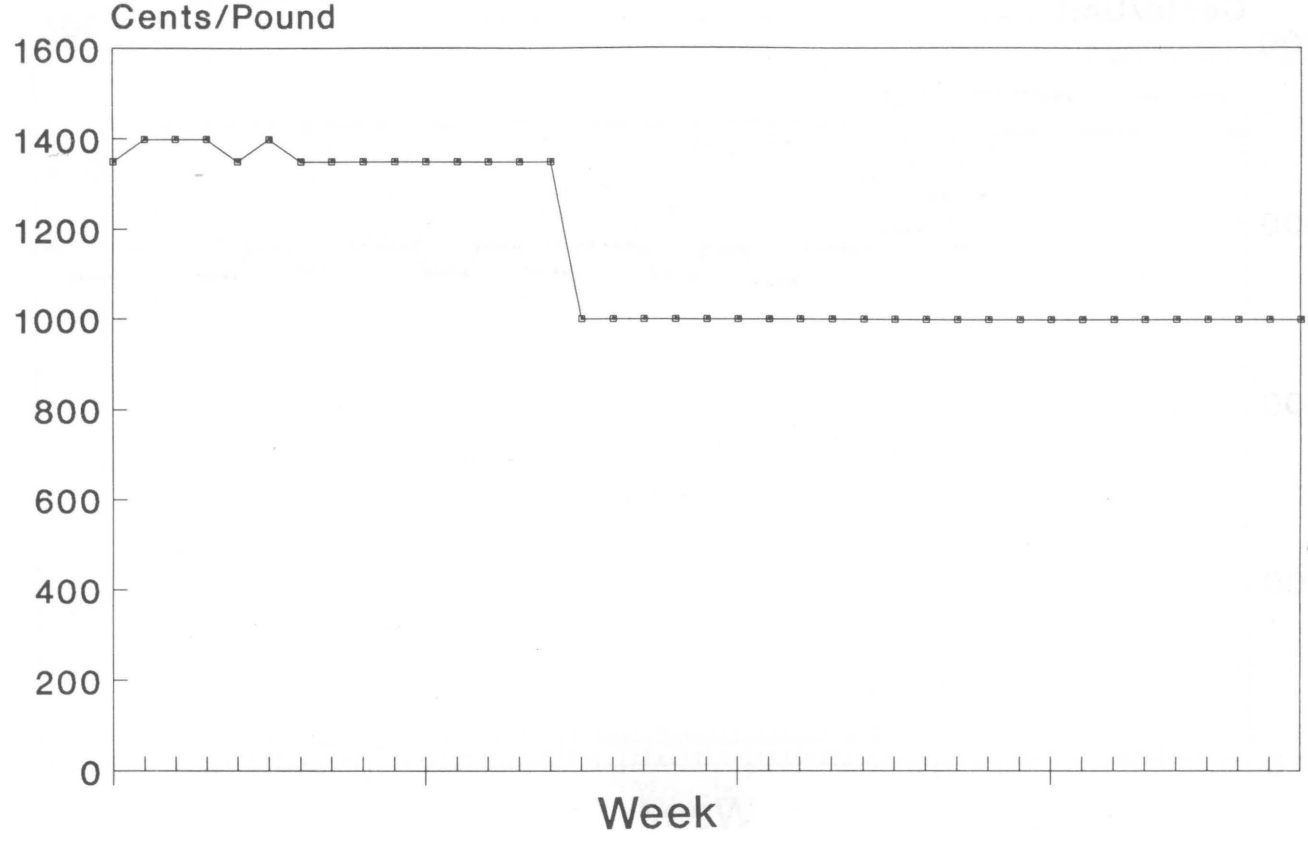


Figure A.12. Price of frozen cooked crawfish meat (UPC 20613600000).



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